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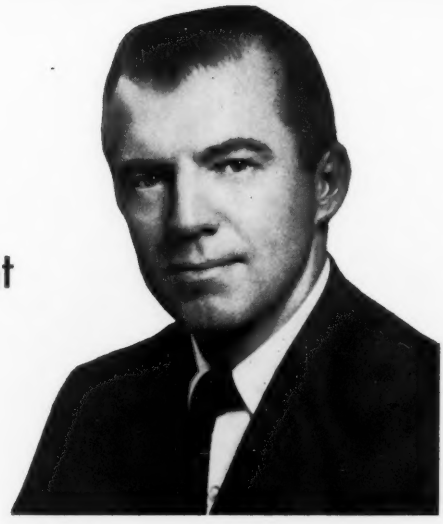
from your president



The recent Annual Meeting of A.S.D.C., held in New York City, was the largest and one of the most successful ever held. The final registration exceeded 1,000. The scientific programs were so well attended that "standing room only" audiences were frequent occurrences. The social program was intriguing and organized with the spice for which New Yorkers are so well known. Although "Thanks" seem to be an insignificant reward for the men and women who worked for almost two years to assure the success of this Meeting, nevertheless we extend deepest gratitude to M. Joel Freedman, the convention coordinator, to Harold K. Addelston, the immediate Past President, and to the host of coworkers who expended so much time and energy for the good of A.S.D.C.

Two Special Committees have been appointed for 1959-60. One of these, the Program Committee, will assist local Units in the planning of programs for future Annual Meetings. This committee will help to organize programs and select speakers and clinicians on a national basis and will serve to relieve the host Units, at least partially, of a troublesome responsibility. The second committee, on Pre-Paid Dental Care Programs, will accumulate information on a number of such programs now in use throughout the country and determine if it is logical for A.S.D.C. to develop a program of its own in preparation for future demands.

Since the House of Delegates of the A.D.A. approved the policies on specialties and specialists proposed by the Council on Dental Education, it is certain that the Council will call together all interested groups for a workshop-type meeting early in 1960 to group or re-group the various specialties. A.S.D.C. will be represented at this meeting, and you may be certain that the resolution to preserve the integrity of pedodontics as a specialty which was passed at the Annual Business Meeting of A.S.D.C. will be presented.

In his President's Message, Harold K. Addelston proposed an increase in dues from five to ten dollars. The Reference Committee supported this proposal but suggested that action on this matter be deferred until the 1960 Annual Meeting. In a future issue of the JOURNAL a current financial statement and the budget for 1959-60 will appear. With this information and with the knowledge of planned future activities of A.S.D.C., the membership should be able to determine whether or not a dues increase is logical and can vote accordingly at the proper time.

The President's column will include information on pertinent activities of your officers and committees through 1959-60. It is hoped that these activities will bring about continued growth and prestige for A.S.D.C.

WILLIAM E. BROWN

Effects of Formol-Cresol on the Dental Pulp*

MAURY MASSLER, D.D.S., M.S.**
NIRMALA MANSUKHANI, D.D.S., M.S.

INTRODUCTION

ONE of the major problems in dentistry for children is the treatment of the dental pulp which has been exposed by caries. A variety of techniques have been advocated and used to preserve such teeth. These techniques vary from pulp capping to vital pulp amputation, pulp mummification, pulp devitalization, to pulpectomy and root canal fillings.

Combinations of formaldehyde and cresols have been used for many years in treating teeth, especially primary teeth, with pulp exposures. Gysi's triopaste (tricresol 10 cc., creolin (Pearson) 20 cc., glycerin 4 cc., paraformaldehyde 20 cc., zinc oxide 60 gm.) was one of the first such combinations to enjoy wide popularity in both Europe and the U. S. A. It was superseded in this country by Buckley's formula (cresol 35 per cent and formaldehyde 19 per cent in aqueous glycerin solution). Cresolated formaldehyde, N.F.V., consists of orthocresol 40 per cent and formaldehyde solution 60 per cent. This preparation is "very irritating and its routine use in the treatment of pulp canal and periapical infections is therefore contraindicated" (Accepted Dental Remedies, A.D.A., 1959, p. 98). Cresolated formaldehyde, N.F.V., is not used clinically very often, but Buckley's formula enjoys widespread use and was therefore the medicament used in this study (Sweet, 1958). This combination will be referred to as "formol-cresol." In spite of its clinical success and wide use, very few histological studies have been conducted to determine its effects upon the pulp.

It was the purpose of this investigation to observe histologically the pulpal response to formol-cresol in the molar teeth of rats (Part I) and primary and permanent teeth of patients treated clinically (Part II). The former was chosen because rat teeth are more easily available in large quantities and can be subjected to experimental analysis under more carefully controlled conditions. The human series was studied to bridge the gap from the animal to human studies because basically, this study lies in the area of clinical therapeutics.

PART I. ANIMAL SERIES

METHODS AND MATERIALS

Amputations and application of the test drug was performed in 205 upper first molar teeth of 95 male hooded rats aged 69 to 140 days. The anesthetized animals were operated as described by Maurice and Schour (1955), Miyamato (1957) and Berman (1957).

Both right and left maxillary molars were used in this study with a different

* Part of a thesis submitted by Dr. Mansukhani in partial fulfillment of the requirements for the degree of Master of Science in Pedodontics in the Graduate College at the Chicago Professional Colleges of the University of Illinois, 1959. (This study was supported in part by a grant from the Pedodontic Research Group of California and by Dr. Charles A. Sweet, Sr.)

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treatment on each side in an attempt to produce matched controls for the various medicaments used (formol-cresol, formalin, cresol, and water). After the pulp amputation was completed and bleeding had ceased, the area was cleaned and a small sterile paper point saturated with one of the medicaments was placed over the exposure. This was left for 2 to 5 minutes before sealing the cavity to make sure that the medicament was in contact with the pulp.

Medicaments. It was important to determine the pulpal reactions to the individual components of the solution as well as to the formol-cresol combination. This investigation therefore included the following treatments:

1. Formol-cresol solution (Buckley).* This contains formaldehyde 19 per cent and cresol 35 per cent in aqueous glycerin solution.

2. Formaldehyde solution 7.4 per cent. This was made by diluting a stock solution of formalin (formaldehyde gas 38 per cent in water) with distilled water to make a 20 per cent solution of formalin. This is equivalent to a 7.4 per cent solution of formaldehyde gas in water.

3. Cresol solution (U.S.P.). A mixture of water soluble tricresols.

4. Distilled water was applied to one series, as a control.

In each series the teeth were divided into two groups. In one, zinc oxide-eugenol cement was placed over the paper point containing the medicament and the rest of the cavity was filled with amalgam. In a comparable number of teeth the amalgam was placed directly over the paper point and the zinc oxide-eugenol was omitted to eliminate any possible effects which the eugenol might have on the pulp or on the action of the formol-cresol.

Survival. The animals were sacrificed at three, seven, fourteen, twenty-one and twenty-eight days by placing them in an ether chamber. They were then decapitated and the molars dissected out.

Histologic Technique. The specimens were fixed in Zenker's formol solution for sixteen hours and then washed under running water for 24 hours. They were then decalcified in 5 per cent nitric acid for 48 hours, and again washed in running water overnight, dehydrated and embedded in paraffin. The sections were cut serially through the exposure at 8 to 10 microns thickness and stained with hematoxylin and eosin or Mallory's triple connective tissue stain.

Findings

A. Pattern of Pulpal Healing

The pulpal reactions under water or any of the medicaments used could be divided into four distinct stages (table 1). There was first an acute and severe inflammatory reaction with large numbers of polymorphs concentrated under the site of amputation (figure 1). This occurred during the first week and was probably the result of the surgical procedure rather than the medicament used since it occurred under the water saturated cotton dressing as well as under each one of the medicaments used. This reaction has also been described under calcium hydroxide and zinc oxide-eugenol by Berman (1957) and under a variety of capping materials used by Miyamoto (1957). This may be referred to as *the acute inflammatory reaction* (table 1 and figure 1).

By the seventh day after amputation the inflammatory area was surrounded

* Distributed by Crosby Laboratories, Burbank, California, as Buckley's Formocresol.

TABLE 1

STAGES IN PULPAL HEALING

(under zinc oxide-eugenol covering)

Stage 1	*Acute Inflammatory Reaction*
3 days	Massive infiltration of polymorphs, concentrated in the pulp immediately under the site of amputation. Pulp below is normal.
7 days	*Localization of Inflammatory Zone by Fibrous Band*
	Localization of polymorphs by fibrous band. Inflammatory cells at site of amputation tend to degenerate. Engorged vessels under the fibrous band. Pulp below is normal.
Stage 2	*Calcification of Fibrous Band (Defense Reaction)*
14 days	The number of inflammatory cells becomes greatly reduced under water covered controls. Not greatly reduced under formol-cresol or cresol. Increased under formaldehyde. Cells at the surface are necrotic. Formation of dense fibrous layer with encapsulated cells (scar tissue) under zone of inflammation. The fibrous capsule becomes calcified, forming a temporary bridge (Berman, 1957). Vascularization of pulp under temporary bridge. Pulp below is normal.
Stage 3	*Reparative Dentin Formation*
14 days	Secondary dentin formation by old odontoblasts just lateral to site of amputation. Reparative dentin formation under temporary bridge of calcified fibers by new odontoblasts.
21 days	Lateral and central reparative dentin formation well advanced under water controls. Central repair absent under formol-cresol, cresol and formalin.
28 days	Bridging by coalescence of lateral and central reparative dentin complete under water controls; incomplete under formol-cresol and cresol; not present under formaldehyde.

by a fibrous connective tissue band. This served to encapsulate and wall off the inflammatory cells (figure 1). This fibrous capsule was sometimes thin and dense (as under the controls) or loosely woven and wide (as under the formaldehyde solution).

By the fourteenth day, the next stage become apparent—*the defense reaction.* The number of polymorphs in the inflammatory zone became markedly reduced and the fibrous band between the degenerating inflammatory zone above and the normal pulp below became calcified. This calcific reaction was concomitant with the appearance of thick fibrous strands with entrapped large degenerating cells. The matrix between the fibers and the cells appeared to precipitate out and stained heavily with hematoxylin, suggesting a calcific reaction. This area has been called a scar tissue, the necrobiotic reaction, an area of calcific degeneration or the primary bridge (Berman and Massler, 1958). It represents a defense reaction at the junction between the degenerating zone of inflammatory cells above and the vital pulp below, and serves to wall off the inflammatory zone from normal pulp tissue.

By the fourteenth day, the inflammatory cells near the site of amputation showed necrotic changes so that this zone which was inflammatory in character at 3 and 7 days appeared as a zone of necrosis by the fourteenth day. When the defensive reaction was successful (as under the water controls) it was followed by the formation of reparative dentin. When the defense reaction was unsuccessful (as under formaldehyde solution) the fibrous capsule did not form, or disintegrated if it had formed. The inflammatory cells were not encapsulated but diffused into the underlying pulp

tissue. The pulp was then considered to be inflamed.

At approximately the same time that the calcified fibrous capsule was forming at 14 days after amputation, secondary dentin began to form on the walls of the primary dentin adjacent to the site of amputation (figures 1 and 2). The old odontoblasts in this area appeared to be stimulated to form secondary dentin. It was clear that this formation began early and was produced by the old odontoblasts resident in the area. This formation was probably related to the surgical trauma and not to the medicament since it appeared under every medicament used in this series and under every capping agent used by Miyamoto (1957) and by Berman (1957). It may be considered to be a form of reparative dentin but will be referred to in this paper as secondary dentin to distinguish it from

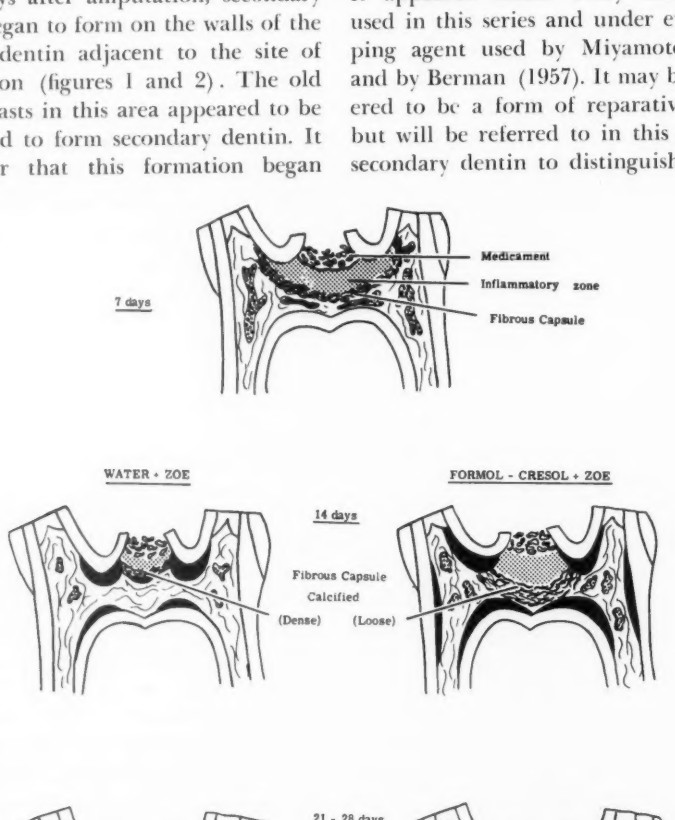

FIGURE 1. Diagrams illustrating the pulpal reactions under water (control) and formol-cresol after surgical amputation in rat molars. Both were covered with zinc oxide-eugenol (ZOE) and amalgam. Note that the reaction is the same under both substances at 7 days (inflammatory zone surrounded by a fibrous capsule). At 14 days, the fibrous capsule is dense and calcified under the water but loosely arranged under the formol-cresol. At 21 to 28 days the bridging under the water is formed centrally but under the formol-cresol bridging occurs laterally.

the truly reparative dentin which was formed centrally by newly differentiated odontoblasts immediately under the calcified fibrous layer (figure 2).

As soon as the fibrous layer became well organized and calcified, the pulp tissue immediately below showed a marked increase in vascularity and a layer of irregular reparative dentin began to form against the calcified layer (figure 1). This occurred early and regularly at 14 days under the water controls, later and irregularly at 28 days under formol-cresol, but not at all under the formaldehyde solution. A true layer of odontoblasts appeared only after the first layer of dentin had become quite thick and the structure of the reparative dentin had become quite regular and tubular.

By 21 days, under optimal conditions, the formations of secondary and reparative dentin were well advanced along the lateral walls and under the central area.

TABLE 2

EFFECTS OF WATER ON AMPUTATED PULPS OF RAT MOLARS (CONTROL SERIES)

*Condition of Pulp**	*Covered With ZOE** and Amalgam*		*Covered With Amalgam Only*	
	No.	%	No.	%
Necrotic	0	0	6	55
Inflamed	0	0	4	36
Healing	7	100	1	9
	7	100	11	100

* Seven to 28 days after amputation. Differences were not apparent at 3 days. (For a detailed description of each specimen and group of specimens, see the Master of Science Thesis by Mansukhani, 1959.)

** ZOE = Zinc Oxide-Eugenol.

TABLE 3

EFFECTS OF FORMOL-CRESOL (BUCKLEY'S) ON AMPUTATED PULPS OF RAT MOLARS

*Condition of Pulp**	*Covered With ZOE** and Amalgam*		*Covered With Amalgam Only*	
	No.	%	No.	%
Necrotic	5	14	16	64
Inflamed	4	11	7	28
Healing	28	75	2	8
	37	100	25	100

* See table 2.

** See table 2.

The inflammatory zone under the site of amputation was now completely degenerated. From the 21st to 28th day, the formation of reparative dentin continued centrally until it met with the secondary dentin which had been forming laterally and coalesced with it forming a complete dentin bridge (figures 1 and 2). This bridge completely closed over the exposed pulp once again (complete "healing"). If the amputation site was small, bridging of the gap could occur by the coalescence of secondary dentin forming along opposite walls without

TABLE 4

EFFECTS OF FORMALDEHYDE 7.4% ON AMPUTATED PULPS OF RAT MOLARS

*Condition of Pulp**	*Covered With ZOE** and Amalgam*		*Covered With Amalgam Only*	
	No.	%	No.	%
Necrotic	2	20	18	72
Inflamed	4	40	2	8
Healing	4	40	5	20
	10	100	25	100

* See table 2.

** See table 2.

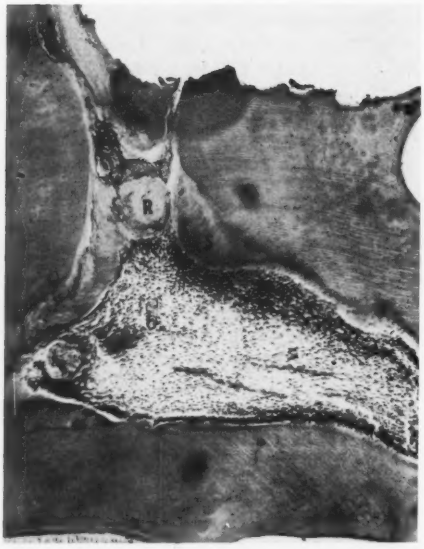

FIGURE 2. Photomicrograph showing pulpal healing under water in a rat molar 21 days after surgical amputation. The water was absorbed on a paper point and covered with zinc oxide-eugenol and amalgam. Note the complete bridging by the formation of secondary dentin (S) lateral to the exposure and reparative dentin (R) under the exposure. (H. and E. x 55).

the aid of centrally formed dentin (figure 1). The site of amputation with the medicament, the residue of necrotic inflammatory cells and degenerated pulpal tissue is now completely walled off from normal healthy pulp tissue below by a thick wall of newly formed and tubular reparative and secondary dentin.

Healing by complete bridging was the rule under the water controls at 21 days (table 2). It occurred erratically under formol-cresol (table 3) but did not occur under the formaldehyde solution (table 4).

The pattern of pulpal healing as outlined above is essentially similar to that described in detail by Berman (1957) as occurring under both calcium hydroxide and under zinc oxide-eugenol. Berman (1957) found this process to occur more quickly under the coagulated mass produced by calcium hydroxide and more slowly under the more benign dressing of zinc oxide and eugenol. The time schedule described here under water (covered by zinc oxide and eugenol) fell somewhat between those described by Berman (1957).

B. HEALING UNDER WATER (CONTROLS)

Pulpal healing under the water saturated paper points covered with zinc oxide-eugenol and amalgam followed closely the pattern and the schedule described above i.e. reduction of inflammation by the 14th day after amputation with encapsulation by a dense capsule of calcified fibers; formation of secondary dentin next to the site of amputation well advanced, with reparative den-

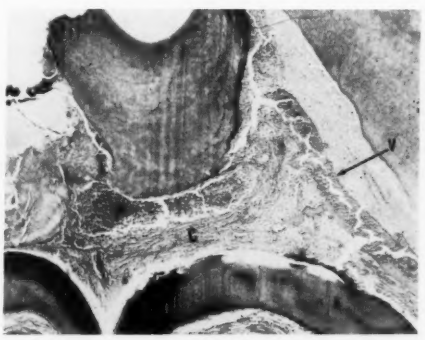

FIGURE 3. Photomicrograph showing the pulpal reaction under formol-cresol in a rat molar, 7 days after amputation, when the medicament was covered with zinc oxide-eugenol and amalgam. Note the polymorphonuclear leucocytes (P) concentrated under the site of exposure and the collagenous fibrous band (C) under this zone. Note the engorged vessel (V) in the pulp below the fibrous band. (Mallory stain, x 50).

tin formation under the capsule beginning at 14 days; bridging almost completed by 21 days in all the specimens (figure 2). All the specimens in this group healed (table 2 left column). When the zinc oxide-eugenol dressing was omitted (to eliminate any possible influence on pulpal healing by the eugenol) healing was retarded and the majority of the specimens showed inflamed and necrotic pulps (table 2 right column).

C. PULPAL REACTIONS UNDER FORMOL-CRESOL

The pulpal reactions under formol-cresol covered with zinc oxide-eugenol were essentially the same as under the water controls during the 3rd, 7th and even the 14th day after amputation (figure 3). There was less reparative dentin formed centrally at 14 days when compared to the controls, but otherwise the two series were quite similar and could not be easily separated.

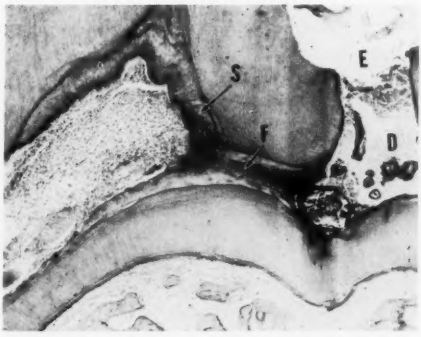

FIGURE 4. Photomicrograph showing a favorable pulpal reaction under formol-cresol covered with zinc oxide-eugenol and amalgam, 28 days after surgical amputation. Note the large amount of secondary dentin (S) formed lateral to the exposure. The central portion is fibrous (F). This bridge was formed at a distance from the site of exposure (E). D, degenerated pulp tissue. (H. and E. x 50).

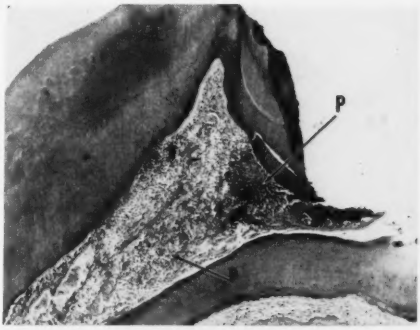

FIGURE 5. Photomicrograph showing the marked inflammatory reaction to formol-cresol 7 days after amputation when the medicament was covered with amalgam only. Note absence of an encapsulating fibrous band and the polymorphonuclear leucocytes (P) in the underlying pulp tissue. Compare with figure 3. (H. and E. x 50).

However, the picture changed markedly at 21 days. Bridging was almost completed in the control series but was erratic under formol-cresol, being retarded in some and absent in most specimens. The formation of secondary dentin along the lateral walls did not seem to be interfered with, and in fact seemed even more exuberant than in the controls, but the formation of centrally placed reparative dentin was completely absent, this area being occupied by a wide diffused layer of calcified fibers with entrapped cells (figure 4).

Under formol-cresol, the pulp tissue within the root canals distant from the site of amputation often showed fibrosis and the formation of an "irritational" type of coarsely fibrous and irregular dentin along the walls of the canal. It began to form at 14 days and was quite prominent at 28 days. It probably represented a fibrotic reaction on the part of the pulp to irritations derived from the formaldehyde in the formol-cresol because it was even more prominent and

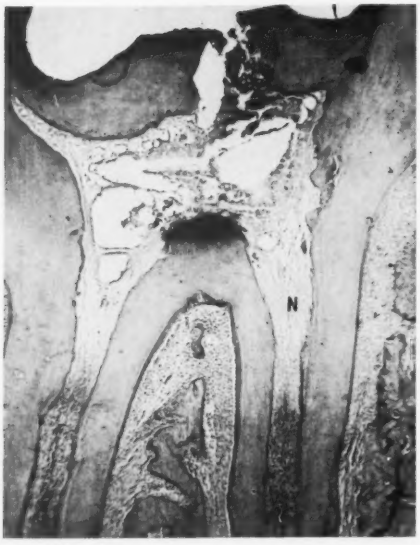

FIGURE 6. Photomicrograph showing the unfavorable pulpal reaction to formol-cresol 21 days after surgical amputation when the medicament was covered with amalgam only. Note the necrosis (N) of the pulp progressing into the canal. Compare with figure 4. (H. and E. x 51).

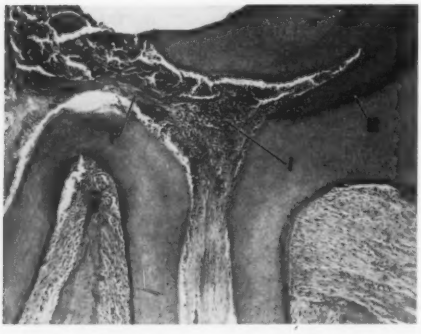

FIGURE 7. Photomicrograph showing pulpal reaction under formaldehyde solution (7.4 per cent) covered with zinc oxide-eugenol and amalgam, 7 days after surgical amputation. Note the loose fibrous capsule (F) and the inflammatory cells (I) in the underlying pulp. Note also penetration of mercury (M) from the amalgam filling into the dentinal tubules underneath. Compare with figure 3. (H. and E. x 43).

appeared earlier under the formaldehyde solution. Irritational dentin formation within the canals was seen less often under the cresol and was only occasionally present in the controls.

As was clearly apparent under the water covered controls, the omission of the zinc oxide-eugenol covering also reduced the healing rate and markedly increased the frequency of inflamed and necrotic pulps under the formol-cresol dressing (table 3 right column and figure 5). Almost all specimens not covered with zinc oxide-eugenol became necrotic after 21 days under formol-cresol (figure 6).

D. PULPAL REACTIONS UNDER FORMALDEHYDE SOLUTION (7.4 PER CENT)

The formaldehyde solution produced a marked increase in the inflammatory reaction and the size of the inflammatory zone as early as 3 days after application. This was quite evident at 7 days (figure 7). The inflammatory reaction did not subside at 14 days as under water and formol-cresol, but showed a marked increase. Localization by the formation of a fibrous capsule was markedly delayed or absent. When a capsule was formed it was loosely woven and incomplete. There was no evidence of reparative dentin formation centrally but secondary dentin formation along the lateral walls was only slightly less than under the formol-cresol or in the controls. Formation of irritational dentin in the canals and fibrosis of the pulp however was frequent and prominent (figure 8).

In this series as in the previous two groups, omission of the zinc oxide-eugenol dressing under the amalgam filling resulted in a decided increase in the percentage of necrotic pulps (table 4 right column and figure 9).

FIGURE 8. Photomicrograph showing the pulpal reaction under formaldehyde solution (7.4 per cent) covered with zinc oxide-eugenol and amalgam, 21 days after surgical amputation. Note the absence of a fibrous capsule or calcific bridge and the irritational dentin (I) along the walls deep in the canal. (H. and E. x 55).

FIGURE 9. Photomicrograph showing pulpal degeneration under formaldehyde solution (7.4 per cent) covered with amalgam only, 21 days after surgical amputation. The pulp is completely necrotic (N). Note the interradicular abscess (A). Compare with figure 7. (H. and E. x 51).

E. PULPAL REACTIONS UNDER CRESOL (U.S.P.)

The effects of cresol covered with zinc oxide-eugenol and amalgam seemed to be somewhere between those produced by formol-cresol and the formaldehyde solution. The inflammatory reaction was less than under formaldehyde. The defense reaction (formation of a calcified fiberous capsule) was less than under formol-cresol and the reparative reaction was better than under formaldehyde and similar to that observed under formol-cresol (figure 10).

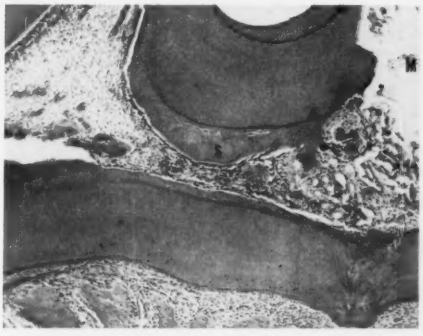

FIGURE 10. Photomicrograph showing a pulpal reaction under cresol covered with zinc oxide-eugenol and amalgam, 21 days after surgical amputation. Note the secondary dentin (S) formed along the walls and absence of reparative dentin in the center. M, medicament. Compare with figure 4. (H. and E. x 23).

Cresol seemed to produce a coagulation necrosis of the pulp tissue and inflammatory cells which come in direct contact with the compound. At 3 and 7 days after amputation, the inflammatory reaction was about the same as seen under formol-cresol but the limiting membrane of fibrotic tissue was less evident (figure 11).

By 14 days, reparative dentin formation along the dentinal walls at a dis-

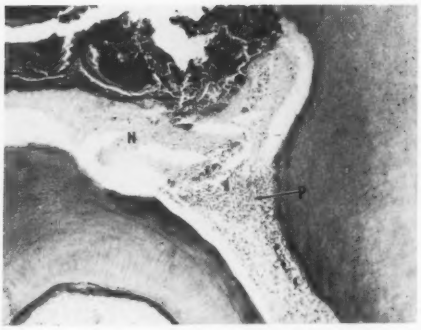

FIGURE 11. Photomicrograph showing the pulpal reaction in a rat molar to cresol which was covered with amalgam only, seven days after surgical amputation. Note the infiltration of polymorphonuclear leucocytes (P) with necrosis at the surface (N). The pulp below is still vital. (H. and E. x 51).

tance from the drug was marked, *but dentin formation near the site of amputation was absent.* This suggests an irritant action by this medicament with stimulation of cell activity at a distance but inhibition of cellular activity nearby.

When a layer of blood or debris intervened between the medicament and the pulp, pulpal degeneration by necrobiosis was the rule.

TABLE 5

EFFECTS OF CRESOL (U.S.P.) ON AMPUTATED PULPS OF RAT MOLARS

*Condition of Pulp**	*Covered With ZOE** and Amalgam*		*Covered With Amalgam Only*	
	No.	%	No.	%
Necrotic	3	21	8	44.5
Inflamed	5	36	8	44.5
Healing	6	43	2	11.0
	14	100	18	100

* See table 2.

** See table 2.

At 21 and 28 days, the characteristic picture under cresol became clear. Secondary dentin formation was present at the periphery only. There was no central repair. Slow necrosis of the pulp was a frequent finding (table 5).

Again this series showed that covering the medicament with zinc oxide-eugenol markedly decreased the number of necrotic specimens and markedly increased the frequency of healed pulps (table 5).

F. SUMMARY OF FINDINGS

Table 6 summarizes and compares the pulpal reaction under water, formol-cresol, formaldehyde 7.4 per cent and cresol when each was covered with zinc oxide-eugenol and sealed with amalgam. The pulpal reaction under formol-cresol was similar to that seen under water during the first 7 days. At 14 days differences began to appear in that reparative dentin formation centrally under the site of amputation was delayed and a fibrous irritational dentin appeared in the root canals. At 21 and 28 days, reparative dentin formation was definitely delayed and fibrotic changes began to appear in the underlying pulp (table 6). Longer survivals might well have shown a more advanced fibrosis of the pulp under formol-cresol.

Formaldehyde solution produced a marked increase in the inflammatory reaction, a delay in walling off the area, with a marked infiltration of inflammatory cells in the underlying pulp, followed by rapid fibrosis.

Cresol produces a pulpal reaction similar to that seen under formol-cresol.

Tables 2, 3, 4 and 5 show that the use of zinc oxide-eugenol between the medicament and the amalgam markedly decreased the incidence of pulpal necrosis

TABLE 6

COMPARISON OF EFFECTS OF DIFFERENT CAPPING AGENTS ON AMPUTATED PULPS OF RAT MOLARS (SEALED WITH ZINC OXIDE-EUGENOL AND AMALGAM)

	Water (Control)	*Formol-Cresol*	*Formaldehyde*	*Cresol*
3 to 7 days				
Inflammatory Reaction	Inflammatory cells closely concentrated under site of amputation.		Inflammatory cells infiltrating into underlying pulp.	Tendency of polymorphs to infiltrate into underlying pulp.
14 days				
Inflammatory Reaction	Marked decrease.	Slight decrease.	Marked increase.	Slight increase.
Defense Reaction (Walling off)	Dense calcified fibrous band surrounding inflammatory zone.	Loose fibrous band (calcified) walling off inflammatory zone.	Wide but loose band of uncalcified fibers surrounding large diffuse inflammatory zone.	Fibrotic capsule walling off inflammatory cells.
Reparative Reaction	Secondary dentin forming along walls lateral to site of amputation.	Beginning of secondary dentin formation laterally.	Secondary dentin may begin to form.	Very little secondary dentin interally.
	Reparative dentin beginning to form centrally under calcified capsule.	No central reparative dentin formation.	No central repair.	No central repair.
Pulp	Normal.	Normal. Irritational dentin forming peripherally.	Inflamed. Irritational dentin deep in root canals.	Normal. Irritational dentin forming peripherally.
21 to 28 days				
Inflammation	Absent.	Present.	Prominent.	Present.
Reparative Reaction	Well advanced. Bridging (by coalescence of lateral and central dentin formation) complete or almost complete.	Inhibited. Dentin formation on lateral walls well advanced but central reparative dentin poor or absent.	Beginning to break down. Some secondary dentin formation at a distance but no central repair.	Similar to formol-cresol.
Pulp	Normal. Some irritational dentin present in canals.	Slightly fibrosed. Irritational dentin along walls of canals, prominent.	Fibrotic. Irritational dentin very prominent along walls of canals.	Slightly fibrosed. Irritational dentin along walls of canals.

No. Necrotic	0		5	(10%)	2	(16%)	3	(18%)
No. Inflamed	0		4	(8%)	4	(30%)	5	(29%)
No. Healing	8	(100%)	40	(82%)	7	(54%)	9	(53%)
Total Number (3 to 28 days)	8	(100%)	49	(100%)	13	(100%)	17	(100%)

and increased the incidence of healing and repair in each series.

PART II. HUMAN SERIES

Methods and Materials

Forty-three primary and permanent teeth were operated for this study under the direction of Drs. I. I. Beechen and C. Emmerson according to a pre-arranged plan. These were submitted to this laboratory for processing and analysis. Some of these teeth were exposed by caries. Some were non-carious and were removed for orthodontic reasons.

A rubber dam was used in some cases and the field of operation was sterilized with tincture of benzalkonium chloride followed with 70 per cent alcohol. The pulps were exposed or the coronal portion was amputated with a sterile bur under local anesthesia. In cases where hemorrhage was excessive it was controlled with sterile cotton pellets or washed with water. The pulp was then cleaned and a dressing of formol-cresol was sealed into the pulp chamber with either zinc oxide-eugenol, zinc phosphate cement or gutta-percha for different periods of time; 1 to 36 minutes, 7 days, 14 days, 30 days, 60 days and 1 to 3 years. The formol-cresol was applied on a saturated cotton pellet or mixed with equal parts of eugenol in a paste of zinc oxide-eugenol and formol-cresol. In two specimens, formol-cresol was applied at the first visit for a period of 7 to 10 days followed by beechwood creosote for a period of 2½ and 3 years. Formol-cresol was also sealed into unexposed cavity preparations of 6 teeth for 7 days to compare its effects on the unexposed pulp.

The teeth were extracted, fixed in 10 per cent formalin solution, decalcified and embedded in celloidin. The sections were cut serially and stained with hematoxylin and eosin or Mallory's triple connective tissue stain.

Findings

The pulpal reactions observed in the human teeth at 7 and 14 days showed some similarities to the inflammatory reaction seen in the rat molars, but there the similarity ended. The human pulps under formol-cresol showed no tendency to wall off the inflammatory zone by either a fibrous layer or a calcific barrier. There was no reparative dentin formation evident either laterally, centrally nor peripherally at any time. Rather, there occurred a progressive fixation of the pulpal tissue, both before and after the acute inflammatory phase, with ulti-

Figure 12. Photomicrograph showing the pulpal reaction to formol-cresol in a human primary lateral incisor 3 minutes after amputation. Note the darkly stained eosinophilic zone at the surface. The pulp below is vital. (H. and E. x 25).

mate fibrosis of the entire pulp after 60 days to one year contact.

Immediate Reaction (1 to 36 minutes) (6 specimens).

The most prominent feature in the histologic sections of pulps to which formol-cresol was applied for one to 36 minutes, was the presence of a layer of deeply eosinophilic staining pulpal tissue at the surface (figure 12). This layer was present consistently and was sharply demarcated from the underlying normal pulp. Mallory's stain showed this area to contain a dense cloud of fine fibers. Inflammatory cells were not present.

The exact nature of this zone is not certain. It is suggested that it represents a layer of "fixed" tissue wherein the proteins in the ground substance was precipitated by the formaldehyde, in vivo.

The eosinophilic zone was usually narrow and limited to the pulpal surface, but extended much deeper into the pulp canal when the formol-cresol was held on a saturated cotton pellet under pressure by a layer of gutta-percha. When dentin debris and hemorrhage intervened between the formol-cresol and the pulp tissue, the zone was much narrower or even absent. This zone was also narrower when the formol-cresol was mixed with zinc oxide-eugenol instead of being saturated on a cotton pellet.

Seven Days (8 specimens).

The most prominent feature of the specimens examined 7 (and 14) days after amputation and application of formol-cresol, was the appearance of three distinct zones (figure 13). There was first the same eosinophilic layer of "fixed" pulp tissue, in contact with the formol-cresol, which was described above. Below this, was a broader pale-staining zone in which the number of cells and fibers were greatly reduced. The failure to stain was quite evident as was the marked decrease in cells and fibers.

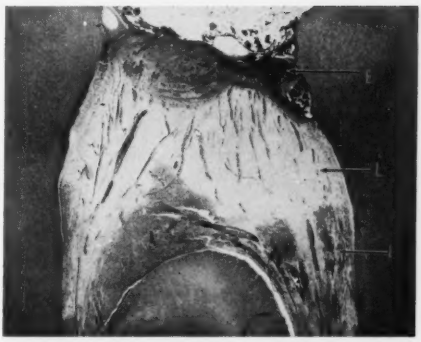

FIGURE 13. Photomicrograph showing pulpal reaction to formol-cresol in a human first premolar seven days after amputation. Note the deeply stained eosinophilic zone (E) at the surface; the pale staining zone (L) below with engorged blood vessels and the inflammatory zone (I) mixed with red blood cells. (H. and E. x 20).

The third layer consisted of a dense accumulation of inflammatory cells (polymorphs) in a sharp line immediately below the pale zone (figure 13). The accumulation of cells was very dense at the border and decreased as one proceeded towards the apex. The pulp below the inflammatory zone appeared to be normal. The blood vessels in this area were characteristically engorged and aligned parallel to the walls of the dentin. In many specimens, these engorged vessels could be seen extending into the pale-staining zone above (figure 13).

A fibrous band could not be found between the inflammatory zone and the normal tissue. The fibrous band encapsulating the inflammatory zone which was so prominent in the rat molar pulps, was not seen at all in the human

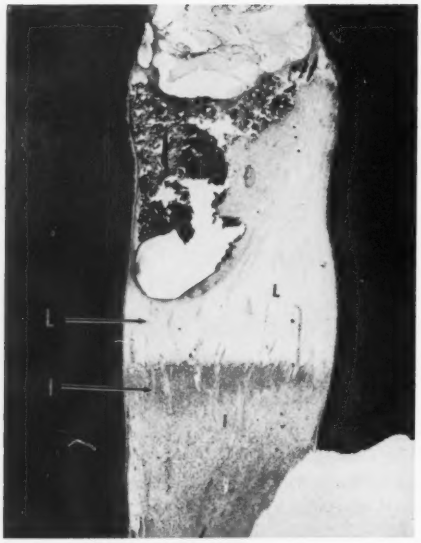

FIGURE 14. Photomicrograph showing the pulpal reaction to formol-cresol in a human primary canine 14 days after amputation. Note the three distinct zones. The eosinophilic zone at the site of exposure is very narrow. The pale staining zone (L) is very wide. I, inflammatory zone. (H. and E. x 25).

series. A sharp demarcation between the inflammatory zone and the normal pulp was not present in the human pulp series.

Fourteen Days (8 specimens).

The three zones described above were still present in the specimens examined 14 days after application of the formol-cresol with no basic differences being apparent (figure 14). The two groups were therefore combined for further analysis.

The surface of the pulp in the human series was frequently covered with a thick layer of dentin debris and blood. This layer of debris and blood was much more prominent in the human teeth than in the rat molars. When the layer of debris was very thick and intervened between the medicament and the pulp, the zones described above were absent and the pulp appeared to be unaffected.

There appeared to be little difference in the pulpal reaction at 7 or 14 days whether the formol-cresol was applied on a saturated cotton pellet or was mixed with the zinc oxide-eugenol paste. The presence of blood and debris showed a greater influence on the pulpal reaction than the method of applying the medicament.

Where the formol-cresol made direct contact with the pulp, a yellow staining of the pulp by the cresol was clearly evident.

FIGURE 15. Photomicrograph showing pulpal reaction to formol-cresol placed in a cavity preparation for 7 days. Note the pale stained zone (L) and the inflammatory zone (I) below. (H. and E. x 10).

Formol-Cresol Sealed in Cavities for 7 Days (6 specimens).

The effects of the formol-cresol on the *unexposed* pulp when the medicament was sealed into a dentinal cavity for 7 days, were almost identical to that observed under the amputated pulp. The same three zones were apparent in the pulp directly under the cavity. The eosinophilic zone was rather wide. The pale zone was also considerably wider so that the inflammatory zone was much closer to the apex of the tooth (figures 15 and 16). It was quite apparent that freshly cut dentin is very permeable to the formol-cresol and that the pulp reacts the same as when it is in direct contact with this medicament.

Thirty Days (11 specimens).

At 28 to 35 days, the eosinophilic zone at the surface becomes much wider, extending half-way into the root canal or even to the apex so that the entire pulp took on the characteristic deeply eosinophilic stain of the surface layer de-

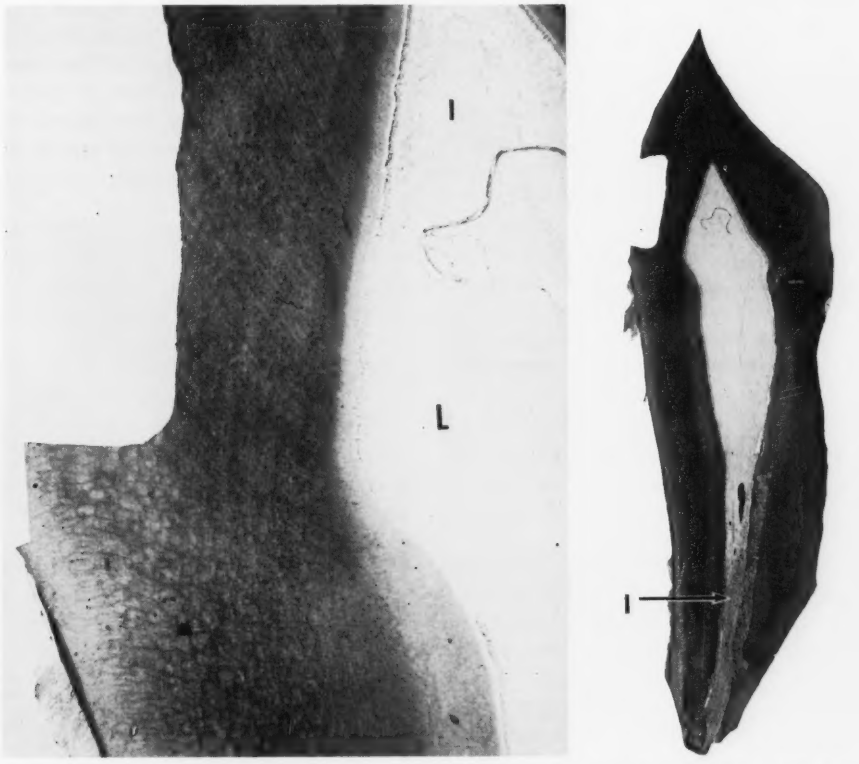

FIGURE 16. Photomicrographs showing the pulpal reaction to formol-cresol sealed for 7 days in a cavity prepared in a lower primary canine. Note the destruction of odontoblasts in the area below the cavity. The pale stained zone (L) is very wide and the inflammatory cells (I) lie near the apex and near the pulpal horn. Low power view on right. (H. and E. x 12); enlarged view on left (H. and E. x 35).

FIGURE 17. Photomicrograph showing the pulpal reaction to formol-cresol in a young human first premolar 35 days after amputation. Note the darkly stained eosinophilic zone (E) at the surface. The pale staining zone (L) is now very wide and reaches almost to the apex. The inflammatory cells (I) are at the apex. (H. and E. x 12).

scribed above. The pale-staining, cell-poor zone could be seen only near the apex while the inflammatory zone was usually absent as if it had been pushed through the apex (figure 17). Unfortunately, the periapical tissue was not available for examination to confirm this conjecture. Mueller (1953) using Gysi's triopaste did find penetration of inflammatory cells through the apex and into the periapical tissue. When the inflammatory zone was present near the apex, it contained a rich supply of engorged vessels oriented parallel to the dentinal walls.

Sixty Days (1 specimen).

The pulp was completely fixed and deeply stained up to the apex, without any shrinkage or fibrosis.

One to 3 years (4 specimens).

The entire pulp was replaced by a thick fibrous strand of structureless material in the center of the canal. It seemed as if the entire pulp had become fibrotic and shriveled—a true mummification (figure 18).

Primary and Permanent Teeth.

There did not appear to be any striking differences between the pulpal reactions in primary and permanent teeth. Perhaps the zoning was more prominent and the fixation went deeper into the

FIGURE 18. Photomicrograph showing the pulpal reaction to formol-cresol (mixed with zinc oxide-eugenol) in a human second primary molar, 2 years after amputation. The pulp is completely fibrosed and shriveled in the center of the canal. (H. and E. x 23).

pulps of the primary teeth, but this series was too small and the specimens were not paired to decide this question fully.

Influence of Caries.

The presence of caries prior to the pulpal amputation did not seem to influence the pulpal reaction to the formol-cresol.

Influence of Zinc Oxide-Eugenol Covering.

Some of the specimens were sealed with zinc oxide-eugenol and others with zinc phosphate cement. There was an impression that the pulp seemed to be fixed more deeply and that more degenerative changes were observed under the zinc phosphate cement, but here again the series was too small and not match-paired for any further statement.

Comment.

This series of human teeth was limited in that the number of specimens observed after one month was very small and not distributed chronologically. Nonetheless it is quite clear that the human pulp did not possess the defensive nor reparative powers exhibited by the rat molars under formol-cresol. Formol-cresol produced a progressive fixation of the human pulp when applied for 7 days or more and a complete fibrotic degeneration when applied for 60 days or more.

Discussion

During the past 35 years, Dr. Charles A. Sweet has taught the use of a formol-cresol combination (Buckley's formula) for the preservation of primary teeth exposed by caries (Sweet and Beechen, 1956). This technique is generally known as "Sweet's Therapeutic Pulpotomy Technique" (Sweet, 1948). It has undergone a number of modifications and at the present time requires two visits (Sweet, 1958; Sweet and Beechen, 1956). The first visit consists of amputating the pulp to the root canals under local anesthesia and sealing a dressing of formol-cresol saturated on a cotton pellet over the site of amputation for a period of seven days. At the second visit one week later, the area is cleaned and a *permanent* dressing is placed, consisting of formol-cresol and eugenol mixed with zinc oxide. This is covered with a zinc phosphate cement and filled with amalgam. Sweet specifically restricts the use of formol-cresol to primary teeth (Sweet, 1959).

Sweet's "Therapeutic Pulpotomy" has enjoyed extraordinary clinical success and popularity especially on the west coast. Thousands of primary teeth which otherwise would have been extracted prematurely have been preserved by this procedure. Its effectiveness is thought to be due to its sterilizing action on dentin and infected pulp, although no studies have been performed to document this conclusion. The pulp also becomes "mummified" and painless and therefore is easily amputated even in a fearful child.

Although generally conceded to be a devitalizing procedure to the pulp, its clinical success has, in general, exceeded the more widely used vital pulp amputations using calcium hydroxide as advocated by Hermann (1930), Zander (1939), Hess (1950), Englander, et al. (1956), James, et al. (1957) and many others.

A number of studies have been made on the action of Gysi's triopaste on the human pulp (Gysi, 1899; Cuendet, 1920; Lutz, 1923; Hess, 1929) the most complete being by O. Mueller (1920, 1929,

1953). Recently, Nacht (1956) reported on the radiographic findings under a modified formaldehyde paste.

Nacht (1956) treated 456 cases with formaldehyde paste (made from a liquid containing phenol, formalin, creosote, thymol, and a powder containing barium sulphate, iodine and paraformaldehyde). The treatment consisted of one visit only. He removed the bulbous portion of the pulp under local anesthesia and applied a thick layer of the formaldehyde paste to the pulp stumps. He then placed a "cement" (probably zinc phosphate cement) over it, and sealed with a permanent filling (amalgam). The results were judged from radiographic evidence only. Radiograms were taken every six months up to a period of five years. Thirty of the 456 cases were lost due to acute symptoms. In general, the teeth were in a good condition radiographically for about two years. After this period there was progressive loss of bone, but no clinical changes were evident. The eventual result was early loss of primary molars and early eruption of the succedaneous permanent teeth.

Mandler (1958) studied the action of formol-cresol on human pulps, histologically. He exposed the pulp of twelve healthy primary and permanent teeth under local anesthesia and applied formol-cresol or beechwood creosote from 5 minutes to 3 years. Histologically, he found that the pulp in contact with the formol-cresol for a short time (about 3 minutes) showed acute inflammation, while prolonged contact (more than 14 days) resulted in amyloid degeneration of the entire pulp.

The present investigation was initiated at the suggestion of Dr. Charles A. Sweet and supported by the Pedodontic Research Group of California. Considerable assistance was provided by Drs. Clinton Emmerson and I. I. Beechen who supplied the human teeth for histological study. The primary and only purpose of this investigation was to study the histologic effects of formol-cresol on the amputated pulp of human primary and permanent teeth and on the pulps of rat molars when this material was applied under controlled conditions.

The rat molar pulp series showed that during the first 14 days after application, formol-cresol permits reparative dentin formation at a distance lateral to the site of amputation but tends to inhibit bridging in the central area near the medicament. Furthermore, it appears that at 21 and 28 days, the formol-cresol tends to break through the incomplete calcific barrier into the underlying pulp tissue causing fibrosis. The pulp then becomes "fixed" and non-reactive.

The human pulp series showed no healing at all under formol-cresol. While its effect in the rat molar was primarily to slow down the healing rate, in the human pulp, a prompt progressive fixation and degeneration occurred. The failure of the human pulp to encapsulate the penetrating inflammatory cells and to halt the advancing fixation and degeneration of the pulp under paraformaldehyde has been noted before by Mueller (1953), Chaneles (1941) and by James and Weinmann (1954). Although the present series is relatively small and chronologically incomplete, it establishes beyond doubt that formol-cresol does *not* promote pulpal healing but does produce a progressive fixation and degeneration (mummification) of the pulp. The reaction of the human pulp under

formol-cresol resembled the destructive reaction in the rat molar when zinc oxide-eugenol was *not* used.

This study also leads to one other important conclusion: the human pulp has a much lower defensive power and a lower healing potential than the pulp in the rat molar. The rapid defensive reaction (encapsulation of the inflammatory zone) and healing (by bridging), so prominent in the rat molar, did not occur at all in the human pulp.

It is clear from these results, that the application of the formol-cresol should be limited to less than 14 days and preferably to less than 7 days. After that time, its destructive action nullifies its beneficial sterilizing action.

It is also clear from these studies, that only when the formol-cresol was sealed in with a paste of zinc oxide-eugenol was any "healing" reaction to be expected. When this sealer was omitted, degenerative changes in the pulp followed swiftly. Whether this result was due to the sealing action of the material and the prevention of marginal leakage along the amalgam filling or to some action by the eugenol is not yet clear.

Clinical Correlations: The high degree of clinical success following the use of formol-cresol is probably due to its potent germicidal action. Certainly its use as a dressing at the first visit to sterilize the infected dentin and pulp, seems justified. However, its continued application after that time is not supported by this study. It seems clear that the application of the formol-cresol should be limited to 7 days or less if the destructive action on the human pulp is to be avoided (while retaining its sterilizing action). Theoretically, its sterilizing action should be completed by the second or third day although, as far as we could determine, no bacteriologic studies have been made on this point. It is suggested that the formol-cresol dressing be removed after 2 to 3 days and replaced by a more palliative dressing to promote pulpal healing. This suggestion is supported by the clinical findings reported by Nacht (1956). He found, in human teeth, early beneficial results under a formaldehyde dressing, but ultimate breakdown of the periapical tissue, radiographically.

The irritant action of the formol-cresol is undoubtedly greatly reduced by incorporating it into a zinc oxide-eugenol paste at the second visit. Its action could probably be made even more palliative if a thin layer of calcium hydroxide were first placed over the amputated pulp before placing the final dressing. In view of the action of calcium hydroxide in promoting bridging (Berman, 1957), this combination seems worthy of further investigation.

Summary and Conclusions

The effects of formol-cresol on amputated pulps were studied histologically in 205 rat molars and 43 human teeth. In the rat molars, no differences from the controls were observed at 7 days after amputation. By the 14th day however, the defensive reaction (fibrous encapsulation of the inflammatory cells followed by calcification of the capsule and reparative dentin formation) began to slow down. At 21 and 28 days, reparative dentin formation was less often present than in the controls. However bridging did occur by the apposition of secondary dentin along the walls lateral to and at some distance from the site of amputation.

Formaldehyde solution (7.4 per cent)

produced an increased inflammatory reaction, a breakdown in the defensive reaction and pulpal fibrosis. Cresol was less irritant than formaldehyde.

In the human teeth, the histological picture was quite different. The surface of the pulp immediately under the formol-cresol became fibrous and acidophilic within a few minutes after the application of the formol-cresol. This was interpreted as a "fixation" of the living tissue. After 7 and 14 days of formol-cresol application, the pulp showed three distinctive zones: a broad acidophilic zone (fixation); a broad pale-staining zone wherein the cells and fibers were greatly diminished (atrophy); and a broad zone of inflammatory cells concentrated at the junction with pale-staining zone and diffusing deeply into the underlying normal pulp tissue to the apex (inflammation). The outstanding difference from the pulpal reaction in the rat molars was the absence of any attempt at fibrous encapsulation of the inflammatory zone. There was no secondary nor reparative dentin formation evident in any of the human specimens examined.

At 30 days, the zones described above had become very broad so that the inflammatory zone was at or through the apex and the pale-staining zone was near the apex. At 60 days and after one year the pulp was completely fixed and remained only as a strand of eosinophilic fibrous tissue.

It was quite evident that the human pulp does not possess the defensive and reparative potentials that characterize the rat molar. Formol-cresol placed on human pulps for more than 14 days produced a fibrous fixation of the living tissue. For maximal effectiveness as a germicide and minimal action on the pulp tissue, it is suggested that formol-cresol be applied for 2 to 3 days and for no more than 7 days.

BIBLIOGRAPHY

BERMAN, D. S.: Factors Influencing Pulpal Healing Following Surgical Amputation in Rat Molars. Master of Science Thesis, University of Illinois, College of Dentistry, 1957.

BERMAN, D. S. and MASSLER, M.: Experimental Pulpotomies in Rat Molars. J. Dent. Res., 37:229, 1958.

BUCKLEY, J. P.: A Rational Treatment for Putrescent Pulps. Dent. Rev., 18:1193, 1904.

CHANELES, J.: El Paraformaldehyde en la Mortification de la Pulpa de les Dientas Temporales. Anales del Anten del. Institute Municipal de Odontologia., 2:1, 1941.

CUENDET, H.: Klinisch-bakteriologische Untersuchungen uber die Wirkung der Trio-paste auf die Gangraena. Schweiz. Vjschr. Zahnheilk., 30:1, 1920.

ENGLANDER, H. R., MASSLER, M., and CARTER, W. J.: Clinical Evaluation of Pulpotomy in Young Adults. J. Dent. Child., 23:48, 1956.

GYSI, A.: Einiges ueber Mumifikationsmittel. Schweiz. Vjschr. fur Zahnheilk., 9:25, 1899.

HERMANN, B. W.: Dentinobliteration der Wurzelkanale nach Behandlung mit Kalzium. Zahnarztl. Rdsch., 21:888, 1930.

HESS, W.: Pulp Amputation as a Method of Treating Root Canal. Dent. Items of Interest, 51:598, 1929.

HESS, W.: Treatment of Teeth With Exposed Healthy Pulps. Internat. D. J., 1:10, 1950.

JAMES, V. E., ENGLANDER, H. R., and MASSLER, M.: Histologic Response of Amputated Pulps to Calcium Compounds and Antibiotics. Oral Surg., Oral Med., and Oral Path., 10:975, 1957.

JAMES, V. E., and WEINMANN, J. P.: Response of Human Pulp to Paraformaldehyde and Cavity Preparation. J. Dent. Res., 33:663. (Abstract No. 52), Oct. 1954.

LUTZ, K.: Histologische and Bakteriologische Untersuchungen uber die Wirkung der Triopaste bei der Pulpa Amputation. Schweiz. Mschr. fur Zahnheilk., 33:81, 1923.

MANDLER, W.: Preliminary Report on the Effects of Formol-Cresol on Vital Human Pulps. Presented Before the American Academy of Pedodontics at St. Louis, Aug. 1958.

MAURICE, C., and SCHOUR, I.: Experimental Cavity Preparation in the Molars of the Rat. J. Dent. Res., 34:429, 1955.

MIYAMOTO, O.: Pulp Reactions Following Surgical Amputations in Rat Molars. Master of Science Thesis, University of Illinois, College of Dentistry, 1957.

MOHAMMED, C. I., and SCHOUR, I.: Pulpal Response of Rat Incisor to Cavity Preparation and Paraformaldehyde. J. Dent. Res., 32:670, 1953 (Abstract).

MOHAMMED, C. I., and SCHOUR, I.: Experimental Cavity Preparations in the Incisor of the Rat. J. Dent. Res., 34:608, Aug. 1955.

MUELLER, O.: Histological and Bacteriological Findings After Pulp Amputation. Dent. Cosmos., 71:57, 1929.

MUELLER, O.: Pulpa und Wurzelbehandlung. Benno Schwabe and Company, 1953, pp. 111-114.

NACHT, M.: A Devitalizing Technic for Pulpotomy in Primary Molars. J. Dent. Child., 23:45, 1956.
SWEET, C. A.: Therapeutic Pulpotomy and Pulpectomy of Primary Teeth in Lippincott's Handbook of Dental Practice by L. I. Grossman. 3rd ed., 1958, pp. 400-404.
SWEET, C. A., Sr., and BEECHEN, I. I.: Operative Dentistry for Children. Chapter 22 in Operative Dentistry by McGehee, True and Inskipp. 4th ed., 1956, pp. 613-619.
SWEET, C. A.: A Handbook of Dental Practice. 1948.
SWEET, C. A.: Personal Communication, 1959.
ZANDER, H. A.: Reaction of the Pulp to Calcium Hydroxide. J. Dent. Res., 18:373, 1939.

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Executive Secretary Tuma Reports

Under the gavel of Dr. James H. Simmons, our new Vice-President and Chairman of the State Units Committee, there were held two friendly and informal meetings of the Unit Secretaries. Mutual problems were discussed and successful State activities were described so that others might profit by these experiences. To your new Executive Secretary it was a pleasant opportunity to meet face-to-face and to learn to know personally a great group of dedicated individuals who had previously been only signatures.

The enthusiasm of all who attended assures that this type of meeting will become a scheduled part of future annual meetings. For those who were not able to attend in person, the following brief review may lead to a better understanding of the aims, activities and administration of your Society.

Each class of membership includes a subscription to the JOURNAL OF DENTISTRY FOR CHILDREN, internationally recognized as the standard reference on the latest scientific thought in CHILDREN'S DENTISTRY. It is our JOURNAL which provides the world-wide unifying and co-ordinating force which brings recognition, and applications for membership from many countries.

General practitioners of dentistry compose the vast majority of our active members, and most of these are members of State Units. Where no State Unit exists active members are classified as Members-at-Large. Active member's annual dues are currently $5.00 for the National Organization, plus the dues of the State Unit, which vary from $1.00 to $20.00.

Associate Members may be elected by the State Units or by the National Body and shall be designated as those working in related fields, as dental internes, dental assistants, dental hygienists, etc. Students in accredited dental schools may be, in like manner, elected to membership. Annual dues for Associate or Student membership is $2.00. Groups of Student Members often organize as Study Groups, elect officers, and present programs.

In some instances, groups of Active Members, whether Members of a Unit, or Members-at-Large may organize a Study Group or Section, for reasons of geography, special interest or convenience. This enthusiasm for Dentistry for Children is encouraged by the Constitution which says in Article IV Section 4 "Component groups may be organized within the State Unit, or without regard to State Unit boundaries, where the members feel that it is justified or desirable for purposes of exchange of ideas or for study and other organized activity concerning dentistry for children. Members of such affiliated groups must maintain their membership in the State Unit in the State in which their practice is located." In this manner, active and alert groups who may be geographically separated from the center of activities of their State Unit may meet at their convenience and with complete local option regarding programs, social activities and local dues. Very fine enthusiastic groups of this kind have been organized in Kansas City, in Cleveland, and in many localities. Your Society is very proud of these evidences of healthy growth which parallels the early development and organization of the American Dental Association.

Space has been provided on the 1960 statements for the addition of such local dues in addition to the State Unit dues so that all may be collected at one time if the Study Group Secretary and the State Unit Secretary wish to so arrange for the convenience of their members. Borrowing a plan of procedure from the A.D.A. it is further suggested that after the State Unit dues are entered on the statement form by the Unit Secretary, the Study Group Secretary may wish to add local dues and mail the statements directly to members within his jurisdiction, collecting the total and forwarding a check for the State and National portion to the Unit Secretary.

He, in turn, will forward a State Unit check for the National dues to the Executive Secretary. Where other methods are more expedient, the local preference of course

is permissible. All memberships within a state must be processed through the State Unit Secretary when a State Unit exists.

In some areas where a member practices in one state in close proximity to the center of activity of the Unit of another state across a river or state boundary, it may be infinitely more convenient for him to participate in the activities of the neighboring State Unit rather than in his own. The constitution requires that he maintain his membership in the State Unit in the State in which he practices dentistry. It is suggested that such members apply for Associate or similar membership in the neighboring State Unit, as a purely local arrangement which need not be reported to the National organization in-as-such as these men are already Active Members through their own State Unit affiliation which includes National Membership rights and a JOURNAL subscription.

Each year your Society awards a "Certificate of Merit" to graduating dental school students who have displayed unusual interest and proficiency in Dentistry for Children. The award includes a subscription to the JOURNAL OF DENTISTRY FOR CHILDREN for the balance of the year of graduation plus the full calendar year following. Similarly, Student Membership includes the balance of the year of joining plus the calendar year following. When such men are invited to attend and made to feel welcome as guests at State Unit or Study Group meetings, they are very likely to seek active affiliation upon expiration of their special membership. These young leaders should never be permitted to lose interest in our worthy cause.

New members who are accepted after October 1 are considered members for the full calendar year which follows. A dentist who is not eligible for membership in a State Unit may be referred to the Executive Secretary for consideration as a Member-at-Large, or as a subscriber to the JOURNAL OF DENTISTRY FOR CHILDREN which is available to everyone, either by direct subscription or through a magazine agency at $5.00 per year.

Undoubtedly there are many other problems of administration or problems arising from misunderstanding which have not yet here been clarified. Bring them to Los Angeles October 14-15-16, 1960 for discussion, or write to:

DR. C. F. TUMA, *Executive Secretary*
13201 Miles Avenue
Cleveland 5, Ohio

A New Approach to the Topical Application of Fluorides in Children With Results at End of Four Years

CHARLES W. GISH,* JOSEPH C. MUHLER,** AND CHARLES L. HOWELL*

IN previous publications the clinical procedure followed throughout this study, and the results at the end of one year,[1] two years[2] and three years[3] were presented. The marked advantage, as to saving of dentist and patient time, of a single topical application of stannous fluoride over the conventional four treatments of sodium fluoride was shown in the clinical results. This paper presents the clinical dental caries data at the end of four years; namely, the results for Group I which began four years ago and which has now received a single application of an 8 per cent solution of stannous fluoride once a year; Group II which started three years ago and has received an application of an 8 per cent solution of stannous fluoride each year; Group III which started two years ago and received an application of an 8 per cent solution of stannous fluoride each year; and, Group IV which started one year ago and has received one application of an 8 per cent solution of stannous fluoride. All groups are compared to their appropriate controls treated simultaneously with a series of four applications of sodium fluoride once each three years. New second grade groups were started each year for four years to complement the original group.

* Indiana State Board of Health, Indianapolis, Indiana.

** Department of Biochemistry, Indiana University Medical Center, Indianapolis, Indiana.

EXPERIMENTAL

The method of dividing the children into their respective treatment groups, the technique of application, and the clinical procedure have been previously described.[1-3] Each group of new second grade children will either receive a single application of stannous fluoride or four applications of sodium fluoride. The group receiving the stannous flouride is being treated once each year, while those receiving sodium fluoride is treated every third year according to the recommended use of sodium fluoride.[4] The same dentist (CWG) is performing all of the clinical examinations.

DATA AND DISCUSSION

The combined dental caries data for the entire four year study period are shown in Table 1. Group I had 362 of the original 554 children available for re-examination after four years. There is a 32 per cent superiority for the children receiving the stannous fluoride as compared to those receiving the sodium fluoride when the DMFT index is used, and a 30 per cent superiority when the DMFS index is used. These reductions are highly significant as shown by the low probabilities for both indices used.

Group II, after three years, has a 35 and 39 per cent superiority of the one application of stannous fluoride over the four applications of sodium fluoride in terms of DMFT and DMFS indices re-

spectively. These reductions are also highly significant as seen in Table 1.

The children in Group III, after two years, show a 17 and 24 per cent superiority for stannous fluoride in terms of DMFT and DMFS indices respectively.

Group IV, at the end of one year, shows a 31 and 31 per cent superiority for one application of stannous fluoride over a series of four applications of sodium fluoride in terms of DMFT and DMFS indices respectively.

The results of this clinical study indicate a continuation of effectiveness after four years of the significant superiority of a single application per year of stannous fluoride over four applications of sodium fluoride at three year intervals. An empirical question regarding this study may be asked, *"What is the actual numerical decrease in the caries prevalence of these children?"* The answer to this question may be the real significance and provide the most accurate evaluation of our progress. During the four year study period the stannous fluoride treated children had a *total* average increment of 1.75 DMFT (0.44 per year). The sodium fluoride treated children had a total increment of 2.77 DMFT (0.69 per year). Both of these increments are very low when compared to other dental caries data in Indiana. While it is not possible to make accurate epidemiological comparisons between communities, it is of considerable interest to compare the actual increments obtained in this study with both the na-

TABLE 1

A COMPARISON OF THE EFFECTIVENESS AT END OF 4 YEARS OF A SINGLE APPLICATION PER YEAR OF AN 8 PER CENT SOLUTION OF STANNOUS FLUORIDE TO A SERIES OF FOUR APPLICATIONS OF SODIUM FLUORIDE ONCE EVERY THREE YEARS

Group	*Time of Examination*	*Agent*	*No. of Subjects*	*DMF Teeth* INCREMENT	*DMF Teeth* % REDUCTION	*DMF Surfaces* INCREMENT	*DMF Surfaces* % REDUCTION
I	1 year	NaF	242	0.76	21 (p=.08)	1.25	26 (p=.025)
		SnF_2	247	0.60		0.93	
	2 year	NaF	222	1.08	32 (p=.004)	1.94	21 (p=.04)
		SnF_2	226	0.73		1.53	
	3 year	NaF	220	1.48	35 (p=.001)	2.68	35 (p=.002)
		SnF_2	196	0.96		1.73	
	4 year	NaF	186	1.76	32 (p=.0005)	3.13	30 (p=.0005)
		SnF_2	176	1.20		2.18	
II	1 year	NaF	237	0.58	59 (p=.0007)	1.19	56 (p=.0002)
		SnF_2	230	0.24		0.52	
	2 year	NaF	235	0.98	46 (p=.001)	1.88	57 (p=.0001)
		SnF_2	222	0.53		0.81	
	3 year	NaF	220	1.13	35 (p=.001)	2.36	39 (p=.0004)
		SnF_2	199	0.74		1.45	
III	1 year	NaF	226	0.84	31 (p=.001)	1.33	35 (p=.001)
		SnF_2	224	0.58		0.86	
	2 year	NaF	215	1.19	17 (p=.004)	2.18	24 (p=.0001)
		SnF_2	210	0.99		1.65	
IV	1 year	NaF	217	0.65	31 (p=.00001)	1.01	31 (p=.00001)
		SnF_2	233	0.45		0.70	

tional caries increments and those obtained in both fluoride and nonfluoride areas. The national average has been estimated to be approximately 1.0-1.4 new DMF teeth per year. If one compares the increment found in the stannous fluoride group with this, one finds a difference in caries increments of 68 per cent. In Indiana, actual verified increment records make comparison more meaningful. These data show the natural caries increments to be approximately 1.02 new DMF teeth per year. (Data taken from similar examinations and combined data from Bloomington, Gas City, Jonesboro, Brazil and Marion County.) If one compares the increment found in the stannous fluoride and sodium fluoride groups with this, one finds a caries increment difference of 57 per cent for the stannous fluoride group and 32 per cent for the sodium fluoride group.

In a fluoride area such as Grand Rapids after 10 years of fluoridation the caries increment[6] is 0.56 new DMF teeth per year (between ages 7-11) and in Aurora, Illinois[7] with 1.2 ppm fluoride in the water supply the increment from ages 7-11 is 0.49 new DMF teeth per year. The stannous fluoride group in this study had 0.44 new DMF teeth per year. If the total prevalence rate can be significantly reduced throughout the ensuing years of high caries incidence real progress has been made in preventive dentistry, especially for the child who cannot or has not had fluoridated water.

The above total increment included teeth erupting during the study period. In a study of this duration, the caries attack rate on teeth erupting during the study period is also of real importance. How does this attack rate for children receiving one application of 8 per cent solution of stannous fluoride each year compare with the attack rate for children receiving a series of four applications of sodium fluoride every three years? The average number of teeth erupting during the four year study period is 12.0 and 12.1 respectively for the stannous fluoride and sodium fluoride treated children (Table 2). The caries attack rate is 4.54 DMFT per 100 erupting teeth for the stannous fluoride treated subjects and 8.29 DMFT per 100 erupting teeth for the sodium fluoride treated children. This represents a 45 per cent difference in attack rates (Table 2). It is possible that the procedure of more frequent treatments may contribute to this difference.

TABLE 2

CARIES ATTACK RATES FOR TEETH ERUPTING DURING A FOUR YEAR STUDY PERIOD IN CHILDREN TREATED WITH EITHER ONE APPLICATION PER YEAR OF AN 8 PER CENT STANNOUS FLUORIDE SOLUTION OR A SERIES OF FOUR APPLICATIONS OF A 2 PER CENT SODIUM FLUORIDE SOLUTION ONCE EVERY THREE YEARS

	NaF	*SnF_2*	% *Difference*
Mean Number Teeth Erupting ..	12.1	12.0	
New DMFT per 100 Erupting Teeth ..	8.29	4.54	45%

Summary

At the end of four years a single application of a freshly prepared 8 per cent solution of stannous fluoride applied once each year was significantly more effective in reducing dental caries in children than a series of four applications of a 2 per cent sodium fluoride solution applied at three year intervals.

These clinical results again indicate a marked advantage in topical fluoride treatment in preventive dentistry due to savings in clinical time, cost, patient and parent convenience and an increase in effectiveness.

This study was supported in part by a grant from the United States Public Health Service.

REFERENCES

1. GISH, C. W., HOWELL, C. L., and MUHLER, J. C.: A New Approach to the Topical Application of Fluorides for the Reduction of Dental Caries in Children. J. Dent. Res. 36:784, 1957.
2. GISH, C. W., HOWELL, C. L., and MUHLER, J. C.: A New Approach to the Topical Application of Fluorides on Children, With Results at the End of Two Years. J. Dent. Child. 24:194, 1957.
3. GISH, C. W., HOWELL, C. L., and MUHLER, J. C.: Stannous Fluoride Vs. Sodium Fluoride—A Progress Report. J. Dent. Child. 25:177, 1958.
4. KNUTSON, J. W.: Sodium Fluoride Solutions: Technic for Application to the Teeth. J.A.D.A. 36:37, 1948.
5. ARNOLD, F. A.: Grand Rapids Study—Results Pertaining to the Eleventh Year of Fluoridation. Am. J. Pub. Hlth. 47:539, May, 1957.
6. ARNOLD, F. A., JR., DEAN, H. T., JAY, P., and KNUTSON, J. W.: Effect of Fluoridated Public Water Supplies on Dental Caries Prevalence. 71:652, July, 1956.

"New York City—1959"

REGISTRATION

Registration—Joe Keller and His Harem.

More Committee Members.

Final Count—1132 Registrations.

The Real Lowdown. Al Anastasia, Bob Facy, Dan Tobin, Sid Kramer, Ralph Ireland.

KNICKERBOCKER WELCOME PARTY

Joel Freedman, General Chairman and Committee Members. "Happy to See Us Happy."

Oliver Campbell, Ovid Slavin, and S. Kramer "Listening to Jack Wells."

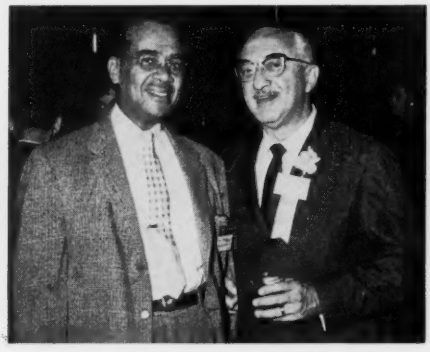
Enjoying the Premedication.

Old Friends Get Together. Paul Weber, John Brauer, Sid Kohn.

. . . And More.

Hospitality Up From the Deep South, Sidney Finn and guests.

Sam Harris, one the founders of ASDC listening to storytellers, Ben Rabinowitch and Bill Hunicutt.

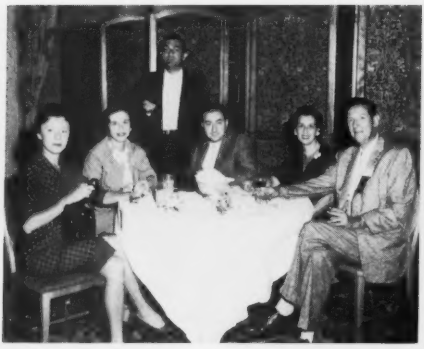


Dean Russell Dixon of Howard University and Harold Addelston.

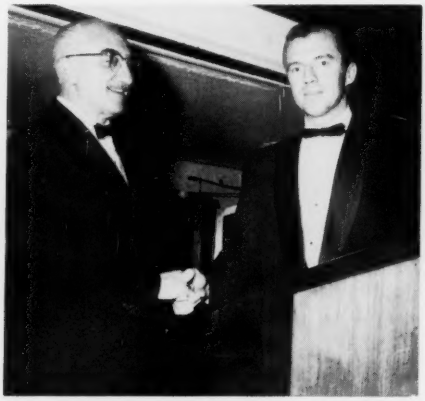
Roy Lindahl and Laren Teutsch surrounded by other ASDC members and their wives.

Well! Abe Kobren asked us to smile.

PRESIDENT'S BANQUET



Some of us would rather sit and watch.



Past President Harold K. Addelston congratulating President William E. Brown.

So would we.

A Warm Welcome to Everyone from the General Chairman, Joel Freedman.

Presentation to President Addelston by M. Joel Freedman.

Summit Conference—Percy Phillips, president of the ADA and Mrs. Phillips chatting with Harold Addelston before the banquet.

Walter Jeffers—President of American Dental Trades Ass'n.

When Presidents Get Together. Dr. and Mrs. Lawrence Burge and Dr. and Mrs. Wm. E. Brown.

Dr. Leona Baumgartner—receiving an Honorary Life Membership in ASDC from President Addelston.

Two of our Dear Friends and Benefactors, Mr. and Mrs. Albert Mizzy.

"ALOHA" FAREWELL PARTY

President of the Host Unit, Arnold Rosenberg, and Friends.

Paul Weber lending a helping hand.

BRUNCH AND FASHION SHOW

Waldorf Astoria

Jane O'Malley, Regina David and Cornelia Thompson listening to Hugh Keenan and Tony Poggi.

From left to right: Mrs. Arnold Rosenberg, Mrs. Roland Hawes, Mrs. William Brown, Mrs. Harold Addelston, chairman, Mrs. Mark Wallach, Mrs. M. Joel Freedman, Mrs. Ralph McDonald, Mrs. Al Seyler.

Dr. Leona Baumgartner chatting with Arthur Buschel, Nathaniel Cooper, Harold Addelston and George Teuscher and wives.

Some of our ladies enjoying the Fashion Show.

What a Wonderful Brunch.

Seton Hall University, School of Dentistry, Jersey City, N. J.

SCIENTIFIC PROGRAMS

Student Pedodontic Society of New York University, College of Dentistry.

Fairfield County Study Groups presenting a clinic on "Treatment of Simple Cross Bite."

Fairleigh Dickinson University, School of Dentistry, Department of Pedodontics, Teaneck, N. J.

Demeritt Pedodontic Study Group, Mt. Olive, North Carolina.

Mixing Acrylic for Construction of Study Models is Dr. James McKnight, University of Tennessee, School of Dentistry.

Management of Injuries to the Young Permanent and Primary Anterior Dentition by Dr. J. Wells, University of Kansas City, School of Dentistry.

"Use of Chrome Steel in Dentistry for Children." Dr. William P. Humphrey, Denver, Colorado.

Orthodontic Aids in Dentistry for Children by Dr. Kenneth M. Platzer, Rockville Centre, N. Y.

"The Reduction of Dental Decay by the Use of Sodium Fluoride Mouthwash." Dr. Walter S. Weiz, Pittsburgh, Penna.

Academy of Dentistry for the Handicapped. Max Bramer, Chicago, Illinois, illustrating "Dentistry for the Handicapped Child."

Another Scientific Table Clinic.

Interesting Table Clinic.

CALIFORNIA . . . HERE WE COME! National meeting at Ambassador Hotel in 1960. Left to right: Bob Read, Ben Rabinowitch, Mode Perry and Hugo Kulstadt.

A most interesting Table Clinic.

Another Scientific Table Clinic.

CHANGING THE GUARD from Ted Levitas to Tiny Konikow.

PRESIDENT'S BANQUET
AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN
HOTEL COMMODORE SEPTEMBER 14, 1952.
EMPIRE PHOTOGRAPHERS

Abstracts—Research Reports*

DIETARY HABITS AND THE DENTAL CARIES EXPERIENCE IN 200 CHILDREN—Ralph E. McDonald and Algeria C. Zita, Indianapolis, Indiana.

Previous studies have suggested a positive relationship between the amount of readily fermentable carbohydrate and the dental caries experience. The frequency of eating and the amount of carbohydrate consumed between meals has also been considered in previous studies, but the results have been controversial and contradictory. From 7 day diet records of 200 children, the frequency of eating was determined, and the total sugar intake and the between meal sugar was calculated as to its carbohydrate equivalent of teaspoons of sugar. The dental caries experience of these children was determined from the clinical examination records and periapical and bite wing radiographs, and recorded as DMFS. The average total sugar intake of these children was 164 teaspoons while the average between meal sugar was 55 teaspoons. A correlation between the total sugar consumed and the DMFS showed that the relationship was not statistically significant. The total between meal eating did not show a statistically significant effect on the dental caries experience. A slight negative relationship was obtained between the total sugar intake and the milk intake, indicating that as the milk intake tends to increase, the sugar tends to decrease and vice versa. A multiple correlation between DMFS and the total sugar and total milk intake showed a negative correlation coefficient.

* Presented before the American Academy of Pedodontics, September 9, 1959, at New York City.

A METHOD OF PREDICTING THE INITIAL ERUPTIVE PATTERN OF THE MANDIBULAR PERMANENT ANTERIORS BY RADIOGRAPHIC ANALYSIS—Milton E. Gellin, Cleveland, Ohio.

This study was undertaken to determine if it were possible to predict the initial eruption position of the mandibular permanent anterior teeth in order to evaluate primary spacing and arch form and detect early beginnings of potential malocclusions. Occlusal x-ray films were taken with the cone placed just posterior to menton with the central beam perpendicular to the film. Ages for x-rays ranged from 3 years, 1 month to 5 years, 10 months. Kodachromes of these same patients were taken at ages ranging from 6 years, 5 months to 9 years, 8 months. The study included 59 children, 32 females and 27 males. Measurements for analysis were made with a Bausch & Lomb Measuring Magnifier. The radiographs were analysed for six characteristics: spacing in the primary dentition, arch form, position of the permanent centrals, position of the permanent laterals, degree of apparent overlap, even alignment, or separation of permanent tooth crowns, distance from the distal of the permanent central to the mesial root of the primary cuspid. The positions of the permanent mandibular anteriors were classified into Ideal Alignment (1 child), Crowded Anteriors Predictable (43 children), Laterals Unpredictable (13 children), and Apparent Growth Discrepancies (2 children). It is suggested that disharmony of tooth size and/or available bone can be predicted as well as the initial eruption positions of the mandibular permanent anteriors. Arch form and spacing of the primary denti-

tion do not appear to be important factors in the initial eruption alignment of mandibular permanent anteriors.

THE EFFECT OF FIRST PERMANENT MOLAR EXTRACTION ON THE PREVALENCE OF DENTAL CARIES—Sidney B. Finn, Birmingham, Alabama.

This study was undertaken to determine whether first molar loss would affect the prevalence of dental caries on the proximal surfaces of the permanent cuspids and bicuspids in the same quadrant as compared to the opposite quadrant in the same arch. Approximately six hundred children from the Alabama State School for the Deaf and Blind received dental examinations, by the same examiner, using sharp explorers under good light. The clinical examinations were augmented with full-mouth bitewing x-ray films. Among the approximately six hundred children, averaging sixteen years of age, there were 192 children with one or more unilateral permanent first molar extractions comprising 229 unilateral missing first molar quadrants. These were divided as follows: 46 in the upper right, 60 in the upper left, 58 in the lower right and 65 in the lower left quadrants. In these quadrants there was a total of 188 DMF surfaces on the proximal surfaces of the two premolars and distal surfaces of the cuspids. In the opposite sides, where first molars were present, there was a total of 304 DMF surfaces in these same areas. Eighty-five of the missing molar quadrants, as well as their opposite quadrants, were completely caries free on these surfaces, and thus were excluded from the tabulations. When the differences of the means for each quadrant were computed, there were statistically significant differences in the DMF prevalence rates on the interproximal surfaces counted. Thus, contrary to the findings of Salzmann, permanent first molar extraction does reduce the prevalence of DMF tooth surfaces if one compares bilateral quadrants.

EFFECT OF PRESSURE ON BRIDGING OF EXPOSED PULPS—Thomas F. Moore, Phoenix, Arizona.

This study was undertaken to establish the beneficial or adverse effect of pressure during pulp capping procedures. All capping was done on vital human upper first permanent bicuspid teeth marked for orthodontic extraction. In each instance calcium hydroxide paste was the capping agent with fast setting zinc oxide and eugenol used as the protective base and filling material. Cavities were prepared under sterile conditions in 22 upper bicuspid teeth. The buccal pulpal horn was mechanically exposed and the exposure size standardized with a No. 2 round bur. The eleven control teeth were capped with a creamy mix of calcium hydroxide and fast setting zinc oxide and eugenol flowed over the capping material. The eleven teeth subjected to pressure were capped in an identical manner, but both the capping material and base were put to place using a spring loaded plugger to insure constant pressure. Three weeks after treatment the teeth were extracted and the exposures examined clinically. In all eleven control teeth a complete dentinal bridge was found at the exposure site. Three of the pressure treated teeth exhibited an incomplete dentinal bridge. Eight of the pressure treated teeth exhibited no dentinal bridge at all. In two cases the patient reported pain reactions on the pressure treated tooth during the three week treatment period. The results obtained would indicate that care should be taken

to avoid pressure during direct pulp capping procedures.

BACTEREMIA AS RELATED TO VITAL PULPOTOMY—Don Laston, Berkeley, California.

Available evidence indicates that transient bacteremia may result from various dental procedures. Even such a relatively innocuous procedure as prophylaxis has been reported to produce bacteremias of short duration. Vital pulpotomies were performed on 22 primary teeth and 13 permanent teeth in 35 children with carious exposures of the pulpal tissues. A standardized technic of pulpotomy under the rubber dam was used. Ten cc. blood samples were drawn prior to the amputation of the pulp; one minute after amputation; and ten minutes after amputation. The blood samples as well as the pulpal tissues of the involved teeth were cultured. All cultures of the pulp tissue were positive for bacterial growth. All blood cultures taken prior to and one minute after amputation were negative for bacterial growth. One sample taken ten minutes after amputation showed a growth hemolytic staphylococcus. Since this bacterial strain was not present in the culture of the pulp of the tooth, it might be inferred that this particular sample was contaminated and did not represent a bacteremia. This limited study might suggest that the safety range of performing a vital pulpotomy on a patient with a known adverse medical history may be broader than has been previously represented.

TRANSIENT BACTEREMIA FOLLOWING DENTAL EXTRACTIONS—Jack E. Wells, Kansas City, Missouri.

Surgical intervention in the oral cavity has been associated with the development of sub-acute bacterial endocarditis. Even the more subtle manipulations such as prophylaxis and mastication has been known to cause a bacteremia. It was felt that the use of a blood sample from a vein closely associated with the oral structures might affect the incidence of bacteremias, the internal jugular vein was selected as the site of collection. Blood taken before and after dental extraction was cultured. Nine children ranging in age from 5 to 12 years were selected as test subjects. These children were in good physical health with no known cardiac involvement and in need of multiple tooth extractions. Under general anesthesia, 10 ml. of blood was obtained from the internal jugular vein before and after extraction. An 8 ml. aliquot was cultured in trypticase soy broth and a 2 ml. aliquot added to a sodium citrate solution for blood agar plates. These plates were cultured and examined at 24 hour intervals under the microscope. The plates were examined for growth until the 7th day of incubation. Only 2 of the 9 post-extraction samples were positive. Gram positive diplococci were found microscopically. The null hypothesis was invoked to show that there was no difference in bacterial septicemia before or after dental extraction.

RETROLENTAL FIBROPLASIA WITH HYPOPLASIA OF THE PRIMARY TEETH—Morris Kelner, Philadelphia, Pennsylvania.

Retrolental fibroplasia is a condition characterized by vascular hyperplasia of the peripheral retina, with the formation of a fibrous membrane behind the lens. It was first described in 1942, and up to 1955 ranked as a major cause of blindness in children. This condition occurs in premature infants of extremely small

birth weights. Clinical research showed the lengthy administration and high concentration of oxygen to be the major cause of retrolental fibroplasia. However, recent reports have pointed out that retrolental fibroplasia may be a local manifestation of a more general disorder. A search of the literature revealed only one article (1955) which mentioned hypoplastic primary enamel in children afflicted with retrolental fibroplasia.

A 4 year and 9 month old boy, with binocular retrolental fibroplasia, was referred for treatment of extensive carious destruction superimposed upon late prenatal or neonatal hypoplastic enamel. The medical history revealed a birth weight of 2 pounds and 7 ounces, 6½ months gestation, and the administration of oxygen for 65 days following birth. The teeth were treated by pulp cappings, pulpotomies, amalgam restorations and stainless steel crowns. In view of recent references to retrolental fibroplasia as a local manifestation of other systemic problems, and the paucity of reports on the dental phenomena of children afflicted with this condition, further investigation and reporting of dental findings in children with retrolental fibroplasia is indicated.

THE EFFECT OF ANTISIALOGOGUES IN CHILDREN—W. Neal Newton and Richard D. Morrison, St. Louis, Missouri.

Several drugs are classified as antisialogogues on the basis of their parasympathetic effects. This study was undertaken to determine the effectiveness of accepted antisialogogues in a controlled clinical situation using as children, ages 8-12, undergoing routine dental treatment. Four compounds in therapeutic doses (atropine sulfate, 0.3 mg.; scopolamine hydrobromide, 0.3 mg.; promethazine hydrochloride, 12.5 mg.; and methantheline bromide, 50 mg.) and two placebos were administered in a crossover, blind test pattern. Twenty-six children received 404 observations of five-minute saliva volumes. These observations were made at the time of medication and at 30, 60 and 90 minute intervals thereafter. A calibrated vial introduced into the saliva ejector systems was used for collection and measurement. Analysis showed that only one of the four tested agents was capable of producing consistent reduction in saliva volume below the levels obtained with the placebos. Methantheline reduced the volume at the three tested intervals following medication sufficiently to be significant at the 95 per cent confidence level. Scopolamine showed a similar reduction only at the ninety minute interval after administration. Promethazine and atropine produced no significant decrease. No unusual side effects were recorded with any of the agents used.

PULP CONSERVATION WITH AN ANTIBIOTIC AGENT—Douglas J. Sanders, Baltimore, Maryland.

The purpose of this study was to determine if, by the adjunctive use of particular drugs incorporating an antibiotic, an effective method could be found for restoring extensively carious teeth. The drugs used in treatment were combined into a paste composed of tetracycline, camphorated parachlorophenol, and calcium hydroxide suspended in a solution of methyl cellulose. Cavities were prepared in the teeth of 38 patients using sterile procedures. The teeth were entirely freed from decayed dentin and undermined enamel. The last scoop of decayed dentin was placed in thioglycollate broth and cultured to determine the

organisms present and, by later tests, to assess the effectiveness of the antibiotic paste on these organisms. All caries was removed even if an exposure was involved. The antibiotic paste was placed in the depth of the cavity followed by a zinc oxide-eugenol liner and zinc phosphate cement. A permanent restoration was then placed. Follow-up radiographs are taken. Thirty-four of the 38 cases were considered successful. Success was considered to have been achieved if all adverse clinical symptoms had disappeared upon re-examination of the patients at a later date. Further study is needed before this method may be used routinely.

FACTORS INFLUENCING THE STATE OF DENTAL HEALTH FOR YOUNG MALE ADULTS PRIOR TO AGE EIGHTEEN—Gordon H. Rovelstad, Bainbridge, Maryland.

The purpose of this report was to evaluate the various factors of health, education, social, economic and personal nature that may have influenced the state of dental health of an individual at any one time of young male adults at the time of entrance to the U. S. Naval Training Center, Bainbridge, Maryland. Naval recruits were examined and subjected to questionnaires and tests upon arrival at the U. S. Naval Training Center, Bainbridge, Maryland, between July and December, 1956. The results of these examinations and the data collected were summarized as typical data describing the young male adult as he presents for military service. From these sources fourteen measures of the state of dental health, in addition to thirty different demographic variables were selected for analysis. The non-dental information was classified according to seven subsets of information and compared to the measures of dental health. Evidence is presented to suggest that many things in the recruit's environment contribute to his dental health: his education status, his family, social, economical and educational status, as well as the frequency of his dental practices and his opinions regarding Dentistry. All are apparently related to certain of the dental measures. There is no strong evidence in these data that the economic factors are markedly influential in determining the state of dental health. Most important class of predictors of dental health contain measures of dental practice and opinions.

THE USE OF CORTISPORIN OINTMENT FOR INFECTED PRIMARY TEETH—M. Michael Cohen, Boston, Massachusetts.

This bacteriological, clinical and roentgenographic study of infected primary teeth treated with cortisporin ointment was carried out to determine the success of a simple method of treatment for infected primary teeth. Thirty-three infected experimental and control primary teeth were treated with cortisporin ointment and a non-medicated ointment using two visits each. Cultures were taken with sterile cotton points of the infected pulp chamber and control culture was taken from the gingiva of the opposite molar in the same jaw. In the experimental teeth, there were two failures, while the control teeth manifested four failures with a return of suppuration and a fistulous tract on the gingiva.

REPORT OF THREE CASES OF JUVENILE PERIODONTOSIS WITH EARLY LOSS OF TEETH—Roland R. Hawes, Rochester, New York.

L. K., female, age nine years, and A. D., a girl, age six years, along with her brother, M. D., age three, have been ob-

served to have a progressive degenerative disease of the periodontium, during the past 3 years. The nine year old girl, L. K., was referred for evaluation of oral aspects of anhidrotic ectodermal dysplasia and allergic dermatitis. Complete dental examination revealed oligodontia with several of the teeth of an atypical form. Severe gingivitis and deep gingival pockets and alveolar resorption were present about the mandibular incisors and first permanent molars. Dermatologic findings were bizarre and included dryness and scaling of the skin and scanty hair of fine texture among the characteristic ectodermal dysplasia features. The patient also had astigmatism, myopia and eighth nerve deafness. The six year old girl, A. D., and her three year old brother, M. D., were referred for evaluation of oral problems after it became evident that an earlier diagnosis of acrodynia was not likely to be tenable for either child. Both children began to shed their primary teeth at the age of 13-16 months, at which time they were also observed to have profuse night sweats and "unusual nervousness." Soreness of the palms and soles followed shortly. There has been development of thick layers of keratin of the palms and soles which occasionally splits leaving bleeding linear crevices. There is a general tendency to hyperkeratinization in skin areas subject to pressure in both children. Dental examination reveals gingival pockets and alveolar bone resorption about all remaining normal primary and permanent teeth. Several of the primary and permanent teeth have been lost due to the degeneration of the periodontium. Medical examinations and laboratory tests are not revealing. A comparison of the clinical findings and biopsy reports in these three cases along with a survey of the pertinent literature lends support to the hypothesis that some cases of periodontosis in childhood can be manifestations of developmental defects, possibly with genetic components.

CONGENITAL ECTODERMAL DYSPLASIA: A CASE HISTORY—Julian B. Raffkind, San Antonio, Texas.

Congenital ectodemal dysplasia is a comparatively rare hereditary disorder, in which ectodermal derivatives are arrested in development during the first trimester of pregnancy. The symptoms are thin hair of scalp and eyebrows, the teeth are partially or entirely absent. When oligodontia occurs the teeth are often peg-shaped. In cases of complete anodontia there is severe closure of the bite due to absence of maxillary process. A girl, aged four years and four months, was referred for oral examination. Physical examination revealed hair that was extremely fine, silky textured, and sparsely distributed. Skin texture was dry and coarse due to the absence of sweat and sebaceous glands. Family history was negative. Oral examination revealed the presence of upper right and upper left primary centrals, upper right primary cuspid, upper right and left second primary molars. The only teeth present in the mandible were the right and left primary cuspids. All teeth were conical in shape except the second primary molars. Radiographic examination revealed the presence of the upper primary cuspids, the upper left permanent central, the upper left permanent first molar. Due to the appearance of the centrals and cuspids, it was decided to make dentures overlaying these teeth. Speech, mastication and appearance were much improved.

MARGINAL PENETRATION OF VARIOUS ISOTOPES AROUND DIFFERENT FILLING MATERIALS—Maury Massler and Robert E. Going, Chicago, Illinois.

Class V cavities were prepared in 245 freshly extracted teeth and filled with different materials. The teeth were immersed in several radioactive solutions (I^{131}, Ca^{45}, S^{35}, p^{32}, Rb^{86}, Na^{22}) for 24 hours. Radio-autographs were prepared under standardized conditions. All the isotopes penetrated into the margins of all fillings but to greatly varying degrees. The order of penetration, from most prominent to least, was: self-curing acrylics, zinc phosphate cements, silicate cements, zinc oxide-eugenol cements, silver amalgam, gold inlay, red copper cement, copper amalgam and gold foil. Calcium hydroxide and cement bases or liners appeared to absorb and to concentrate the radioactive tracers as they penetrated through the margins of the filling. Negative ions were absorbed very strongly on the surface of the metallic fillings but not on the clean enamel surface. Positively charged ions were absorbed strongly on the surface of clean enamel and poorly absorbed on metallic fillings. Marginal penetration occurred much more deeply through the injured enamel rods adjacent to the margin than through the interface. The ability to penetrate into enamel or fillings is in part a function of the charge on the ion.

Book Review

IN THE DENTIST'S OFFICE, edited by G. Archanna Morrison. J. B. Lippincott Co. Price $7.50.

This is the second edition of this book consisting of 280 pages with an index. It is well illustrated, well printed, and on good paper. The sub-title of the book is A GUIDE FOR DENTAL AUXILIARY PERSONNEL. There are contributions by some half dozen dentists headed by the well known Lester W. Burket.

On the whole there are some very good points to be remembered, or to be learned by the beginner. Specifically, this reviewer believes that books of this nature had better be left to the parent profession or member thereof, to develop. One may be reminded of the old saw—"The tail wags the dog." Appointment cards printed on "pastel-colored stock" should have no place in the professional man's paraphernalia. Neither should a folded sheet bearing the appointment and all the material as indicated on pages 82-83 be distributed among the lay public. This harks back to the days of pamphlet distribution, and today might easily fall within the area of the unethical. The fact that the author's name appears on the illustration of this appointment sheet may be only illustrative—it might have been better judgment to have used the proverbial, John Doe. And once more the book would be better off had chapter 3, "Tested Phrases for Personnel," been omitted. Plain, simple words, politely spoken make for a better impression. "Be Yourself" is a good rule for the individual.

JOHN E. GURLEY

Unit News

For this issue of Unit News, reports came by air, by special delivery, by teletype, carrier pigeon and . . . even by a large Isetta! It is really fantastic the way a "deadline" can stir up activities around the country. Seriously, Unit reporters, you did a GREAT job and I'm most grateful. I am anticipating this same sort of response for each issue. O.K.??? I know you won't let me down.

TINY KONIKOW

SOUTHERN CALIFORNIA

Executive Secretary Lorraine Duncan, combined a vacation trip to Washington with a stopover in New York to observe the way ASDC functioned nationally. Lorraine took some very good notes of the problems involved in running a national meeting which will help during the coming year.

The September meeting of the Unit featured Francis J. Garvey, former counsellor for the American Dental Association. Mr. Garvey was a dynamic speaker and his talk on "Legal Aspects in the Practice of Dentistry for Children" was most imformative.

On Oct. 26 Dr. Eugene Ziegler presented "Endodontics for the Young Permanent Tooth" which was well received.

Southern Cal Unit puts out a publication known as *The Children's Chair* which is a quarterly bulletin available to the membership. It is edited by Dr. Bernard Z. Rabinowitch and was created to give the transition between a scientific publication and a newsy personal bulletin. It was felt book reviews, abstracts and viewpoints would be of value to the members, and whenever possible, news of the Society programs would be incorporated for the benefit of the members. The membership has now grown to over 370 members. Al Anderson of San Diego, past national president, "Dutch" Everett of Huntington Park and Jess Hayden, Jr. of Loma Linda were appointed as associate editors.

In order to keep everyone informed as to the progress and planning for the National meeting next year in Los Angeles, *The Children's Chair* will maintain a column of information regarding the meeting.

CANADIAN SOCIETY OF DENTISTRY FOR CHILDREN

President-Elect Peter E. Currie sends this news from his Society:

An attempt will be made in the near future to develop the Canadian Society of Dentistry for Children into Units similar to the American Society of Dentistry for Children.

An Alberta Unit has been formed under the direction of Dr. C. R. Castaldi of the Faculty of Dentistry, University of Alberta, and they have had some very successful meetings. Heretofore, the Canadian Society of Dentistry for Children has operated mainly in Ontario. However, it is the intention of the Executive Council to actively pursue the establishment of Units in as many provinces in Canada as possible. It is hoped that the appointment of a National Secretary will be one of the next steps in establishing a National group.

Plans for the meeting of the Canadian Society of Dentistry for Children in London, Ontario next May are advancing rapidly. A most cordial invitation is extended to members of the American Society of Dentistry for Children to attend this one day seminar.

Good luck, Canadian friends, with your plans for more Units.

Colorado

Louis J. Dubin, outgoing president of the Unit, sent in a brief report. Glad to hear you are going to continue as reporter, Lou.

New officers were installed at the State meeting at the Broadmoor Hotel in Colorado Springs and are as follows:

President	Walter Zeeb
Vice-President	Jack Eisenson
Secretary-Treasurer	Willard Guard

Dr. Henry Tanner, University of Southern California, was the guest speaker at our luncheon and spoke on "The Use of High Speed in Dentistry for Children" and "Pre-Medication in Children's Dentistry."

Colorado's list of pedodontists is still growing. At last count, there were twenty-five and ninety-two members in the Unit.

Coloradoans who attended the National meeting were: Joe Beaghler, Bill Cody, Jack Eisenson, Will Guard, Bill Humphrey, Ben Kletsky and Tomi Kowano.

Will Guard presented a table clinic on "Stress Patterns in Cavity Preparation" and Bill Humphrey presented his favorite subject, "Chrome Steel Crowns in Children's Dentistry."

Connecticut

Dr. Sidney Kohn, professor of Pedodontics at Fairleigh Dickinson University Dental School and president of the American Board of Pedodontics, was the clinician at the Fall meeting of the Unit on Oct. 28 at 10:30. It was a full day meeting held at the Les Shore's Restaurant. The Society picked up the "tab" for luncheon for all paid up members and the turnout was extremely good. The popular CBS news correspondent, Harry Reasoner, was the luncheon speaker.

Connecticut was well represented at the National ASDC convention in New York. Representatives at the Delegates meeting were: Drs. Albert Sasso, Waterbury; Herman Weisler, New London; Elias Fass, Fairfield; Ernest Arnow, Norwalk; Naomi Dunn and Irving Eichenbaum, New Britain; and Emmett Wanamaker, Stamford. Plans are progressing for a two day meeting in the Spring with Dr. Norman Olsen, associate professor and chairman of the department of Pedodontics, Northwestern University, as guest speaker. No dates as yet—more the next time.

Thank you, Ernest Arnow, for enclosing a copy of your newsletter—real interesting.

Florida

Neil Powell advised that thirty members of the Florida Unit attended the ASDC meeting in New York.

The East Coast members of the Florida Society of Dentistry for Children have formed a study group which will meet once a month. Vic Lenchner was elected president and Frances Glenn, secretary.

Big news was the Post-Doctoral Pedodontics Course which was held on November 6, 7, 8 at Nassau in the Bahamas. Dr. Wm. E. Brown, professor of Pedodontics at the University of Michigan, lectured on the following subjects: "Diagnosis and Treatment of Abnormal Development"; "Interceptive Orthodontics" and "Habits." Dr. Melvin A. Noonan, Birmingham, Michigan, spoke on "Practice Management" and "Injuries to Young Permanent Teeth."

These two pedodontists from the Wolverine state presented a terrific program. It's great to live near a coast line where there are so many things to see and do. We understand that Sailor Brown rowed a glass bottom boat through the Nassau Harbor while Captain Mel Noonan surveyed the famous Paradise Beach. (How many malocclusions did you see, Mel?)

Georgia

Bill Shupert reports on the Annual seminar held in October at the Ida Cason Callaway Gardens near Warm Springs, Ga. Approximately thirty members and wives attended. Dr. Roy Lindahl, head of the department of Pedodontics at North Carolina, spoke on "Office Procedures and Management of a Pedodontic Practice" and "Management of the Space Problem in the Child Patient." Six members from the Georgia Unit who made outstanding presentations were: Dr. Joe Meadows on "Bands, Acrylic and X-Rays"; Dr. Julian Kelly on "The Endodonic Age"; Dr. James Carroll on "Correction of Patients' View of Dental Practice Through Education"; Dr. Marilyn Stone on "Stannous Fluoride"; Dr. Edward Friedman on "Dental Education in DeKalb County"; and Dr. Edwin Hibbard on "Plans for Pedodontics at Emory University."

The following officers were elected for 1960:

President	Dr. John Wallace
President-Elect	Dr. Mary Lynn Morgan
Secretary-Treasurer	Dr. Wm. R. Shupert

Members attending the Seminar found time to partake of golf, fishing and boating and good country-style cooking. Also, many good "talk sessions" which seemed to always revolve around dentistry for children.

Hawaii

A note from Joseph M. Yamamoto representing the Hawaii Society of Dentistry for Children was received. He requested that any members of ASDC who might be visiting in Hawaii in the near future and would be willing to present a clinic to contact Dr. Richard Yokoyama, Unit Secretary, 45-781 Kam Hwy, Kaneohe, Hawaii.

Idaho

Had a note from Wes Young saying their Unit hadn't a thing to report for this quarter. So—we will hear from them next time. Congrats are in order to Wes Young on his election as Secretary of the American Society of Dentistry for Children. Nice going, Wes. It's a big job but we know you can do it. Best of luck.

Illinois

No news from the Unit reporter. What happened, Jane Selbe? Heard through the "grapevine," however, that the Illinois Unit has something to be real proud of . . . Dr. Maury Massler, professor and head of the postgraduate Department of Pedodontics, University of Illinois, College of Dentistry, has been granted a Fulbright Award so that he can establish a Pedodontic department in the Dental School in Israel. He and his family will leave for Israel in December. We all wish you the very best of luck, Maury.

Indiana

Yes, dear Elizabeth Graves, reporter from Indiana, you made it! The Indiana Unit held its first meeting in conjunction with the annual Alumni weekend in Bloomington, Indiana, Friday, September 25.

The program, a symposium entitled "Fluoride in Your Practice" was received with great enthusiasm. The subject was covered in three parts by Dr. Charles L. Howell, director of the Division of Dental Health, Indiana State Board of Health, who had as his topic "Introduction of the Problem"; Dr. Charles W. Gish, assistant director of the Division of Health, on "Topical Application of Fluorides for Use in Private Offices"; and Dr. Joseph C. Muhler, research professor from Indiana University, covered the third part on "Fluoride in Other Vehicles and a Look Into the Future." A question and answer discussion followed. The Indiana Unit was well represented at the ASDC meeting in New York and what a WONDERFUL meeting it was! Everyone who had a part in it is to be congratulated for making it one of the greatest. We are all very proud of our own Ralph McDonald who was elected vice-president of the ASDC.

Plans for a three day meeting in April at the French Lick Hotel are being made but more about this later.

Officers for this year are:

President	Richard E. Jennings
President-Elect	Donald C. Dicks
Vice-President	James R. Roche
Secretary-Treasurer	E. R. Rothaar

Maryland

John Sharpley flew in from Baltimore to deliver his news—he did make it tho'.

The Maryland Unit with the cooperation of the Maryland State Dental Association, presented an exhibit on "Dental Education for Teachers" at the Maryland State Teachers Ass'n. convention at Baltimore on October 16-19. This exhibit was enthusiastically received by the teachers who were eager for information and material that could be used in their classrooms for health studies. The members who manned the exhibit were at times hard pressed to answer all of the questions asked by the teachers. The Unit plans to repeat this project next year.

On November 4, 1959, a projected clinical program composed of four clinicians was held. "Interceptive Orthodontics for the General Practitioner" was the topic with the following participating: Dr. Ernest Nuttall, University of Maryland; Dr. Kenneth M. Platzer, New York; Dr. Robert F. Spangler, York, Pa.; and Maryland's own Dr. Barbara Seifert.

Future meetings include a program on "Pulp Therapy as Applied to Children's Dentistry" by Dr. Harold K. Addelston in January; on March 2, 1960, Dr. Manuel Album will lecture on "How to Make Children's Dentistry Pay"; in June, the Annual luncheon meeting with

election of officers at Atlantic City, N. J. and then . . . on to California.

Speaking of National meetings, John and his Unit expressed deep appreciation and sincere congratulations to M. Joel Freedman, general arrangements chairman and his committee for the excellent program, entertainment and warm hospitality received at the New York meeting.

Michigan

Joe Engelman says his Unit is off to a flying start. They had a very successful meeting in Lansing on Oct. 27. It was co-sponsored with the Central District Dental Society and from all reports new friends were made and in all probability, many new members will be forthcoming as a result. Dr. Faustin Weber, professor of Orthodontics at the University of Tennessee was the guest speaker. His lecture on "Interceptive Orthodontics" was well received. He brought out many points which could be used successfully in daily practices.

Great plans are being made for the Children's Dental Health Day program which will be on Feb. 3, 1960, under the chairmanship of Dick Christl and co-chairman, Tiny Konikow. Place is the McGregor Memorial Bldg. at Wayne State University. It will be an all day session with the morning being devoted to a program titled "Dentistry as a Career" and will be mainly for high school counselors, advisors and superintendents of schools to become acquainted with the requirements for dentistry as a career. The afternoon sessions will feature Dr. James Hayward and Dr. Thos. Graber. More on this in the next issue.

This Unit again uses the new idea of co-sponsorship for this meeting by combining the MSDC meeting with the Detroit District Dental Society.

Even tho' the New York meeting is past history, it would not be amiss to say again "many thanks, New York, for the tremendous meeting." Everyone enjoyed it. Your chairmen thought of EVERYTHING. Michigan was mighty proud of its representation and of the Michiganders who presented table clinics.

Minnesota

Here is a unit that is going "great guns." Bob Boller who replaces Rocky Schwarzrock as Unit News reporter did a terrific job on his first assignment of reporting. Just listen. . . . At the meeting on Sept. 24 Manny Album spoke on "Premedication" and "Making Children's Dentistry Pay." Fran Summers had as his topics, "The First Visit" and "Child Management." Two hundred and forty dentists came from five different states to attend the meeting and everyone was well pleased with the wonderful presentations by Manny and Fran. Both boys turned in a cracker-jack of a talk and gave the men plenty to take home.

Also, on the docket for this Fall, Bob Boller will take a long noon hour and slip over to the University of Minnesota Dental School for a talk to the members of the Senior Class. Harold Wittich introduced Bob to the Seniors last year and 71 out of the 80 seniors were signed up for the Minnesota Unit, after a short talk. To quote Bob—"It was easy for Harold Wittich and me to sell ASDC and our splendid Journal, as we are both so completely sold on it ourselves and . . . we hope to do as well, if not better, on Junior memberships this year." (Aren't these a couple of go-getters?)

Norm Kushino is the newly appointed membership chairman and is doing a

great job. Forty new memberships were picked up at the September meeting bringing the total to 275.

On Tuesday, Oct. 20, Irv Posnick reported on the "Jumbo New York Clam Dig." What a report that was!

Future meetings include Dr. Donald Erickson at the November 17 meeting at the Normandy Hotel who will speak on "New Trends in Office Layout as Developed in Cleveland"; Rocky Mountain Demonstration meeting on Jan. 19, 1960; Dr. Bernard Z. Rabinowitch from Beverly Hills, Cal., will be the guest speaker for the February meeting; "Practice Management" is the topic Dr. Mel A. Noonan has chosen for his talk at the March 24 meeting.

Bob, in paying tribute to Rocky Schwarzrock, former news reporter, said "Rocky is an editor in his own right. he and his wife having just published a second edition to their terrific book, *Dental Assisting* by Schwarzrock and Schwarzrock. Every one should read this book."

Just so you can *see* who is responsible for the phenomenal growth and splendid organization of the Minnesota Unit, this picture was forwarded.

The men responsible for the phenomenal growth of the Minnesota Unit. Left to right: Walt Iverson, Rudy Delton, Harold Wittich, Irv Posnick, Ned Brown (front), Bob Boller, Jerry Ulrich and Ray Peterson.

Thanks, Bob, for an excellent report. Keep the news coming.

NEBRASKA

Don Stormberg barely made the deadline with his news.

The Nebraska Unit had what Don termed "their biggest and best program to date" at a two day meeting on Sunday and Monday, October 18 and 19 in Omaha. Members were "on their own" to play golf and enjoy themselves until 2:00 p.m. on Sunday at which time table clinics were presented until 4:00 p.m. A Social hour at 5:30 was followed by dinner at the Town House.

It was the distinct pleasure of the Nebraska Unit to have the Fleege Brothers (Pat and Fran) on their program and from all reports it was the GREATEST.

Following the dinner on Sunday evening, the Fleege Brothers gave a talk on "Pre-Payment Plans, and Dental Service Corporation Pitfalls." Their presentation was both entertaining and informative.

On Monday morning, Dr. Herbert (Pat) Fleege, lectured on "Selection, Management and Dismissal of Personnel." He was followed by Brother Fran who spoke on "Practical Dentistry for Children." After luncheon and a short business meeting, Dr. Herbert Fleege returned to give some very important facts on "Case Presentation"; "Appointments and Solidifying the Recall." Dr. Fran Fleege closed the clinical meeting with a talk on "Dentistry for Children."

The Fleeges are a family of pedodontists . . . four of them, Robert and James are the other two. Hope some of our other Units will have the privilege of hearing them sometime.

New Mexico

David F. Striffler of Santa Fe and I. L. Voda, Las Vegas, N. M. attended the American Society of Dentistry for Children meeting in New York as delegates.

Plans are being made for the Spring meeting to which all members of the New Mexico State Dental Association will be invited.

New Jersey

Our thanks to Elias Lisman for the fine report he sent as new correspondent for the New Jersey Unit.

The New Jersey Unit is started on another active year. With the National convention in New York behind us, plans are already in progress for the 1963 convention which will be held in Atlantic City. Our Unit helped as host Unit for the New York meeting with Paul Weber as chairman. Mel Bellet did a great job handling the registered clinics. Others who helped were: Walter Schwartz, Robert Petrie, Norman Zellen and yours truly, Elias Lisman.

Students from both of our "new" dental schools, Fairleigh Dickinson and Seton Hall Universities, presented table clinics on various phases of pedodontics and were very favorably received. . . . Hope to hear more from these boys after they graduate. Jerome Fechtner presented his own film "Clinical Use of Ultra High Speed Instruments in Dentistry for Children."

Dr. Roy Wolff of Clayton, Missouri, will be the guest speaker at the Annual Mid-Winter meeting on Feb. 17, 1960.

Efforts are underway to enroll students of our New Jersey Dental schools as student members of the ASDC. With past presidents of component Units, Abe Kobren and Sid Kohn, as Pedodontics Department chairmen, this should be a successful venture.

Our Unit has contacted the various component dental societies in the State and the State P.T.A. Association offering the services of our Speakers Bureau to give talks on Children's Dentistry.

For many years the *New Jersey Dental Journal* has allocated the January issue to Dentistry for Children. President-Elect Curtis Hester has arranged for scientific articles to appear in the January issue and will be contributed by the Pedodontic Department of the University of Michigan, School of Dentistry. Among these will be original articles on "The Management of Spaces During the Periods of the Primary and Mixed Dentition." Contributors are: Dr. Kenneth A. Easlick, Dr. Wm. E. Brown, Dr. Jos. T. Hartsook, Dr. Raymond H. Sawusch and Dr. Richard E. Corpron. This promises to be a notable issue.

Plans are going forward for the Annual ASDC meeting of the New Jersey Unit in conjunction with the State meeting in Atlantic City in April 1960 under the direction of Vice-President Wilfred Jordan. More about that the next time.

A very fine report, Elias—keep up the good work.

New York

From Syracuse, Walt Woods again keeps us informed of activities of the Empire State.

The New York State Unit just completed a highly successful two day meeting at Binghamton, N. Y. This get-together was held to acquaint the Sixth District Dental Society with newer concepts in Dentistry for Children.

The highlight was a talk by Dr. Basil G. Bibby, director of the Eastman Dental Dispensary, entitled "Dental

Caries—New Ideas Enlighten Old Problems."

The social affair, a dinner dance, was completed by a short talk on "A Pediatrician Looks at Children's Dental Health" by Dr. Gilbert Forbes, professor of Pediatrics, University of Rochester, School of Medicine and Dentistry. An attempt is being made to reach a better understanding and liaison with the school dental health program.

Dr. Ross Guttman, supervisor of Dental Health Education, New York State Department of Education contributed greatly to the program by his talk on "The Supervising Dentist's Contribution to Children's Dental Health."

The Sunday morning table clinics featured Dr. Alfred Caruana, Dr. Robert Clark, Dr. Hyman Goldberg and Dr. Frederick Halik. Very fine table clinics.

A real treat is in store at the next State meeting to be held on April 2-3, 1960 in Buffalo. Dr. Bob Moyers and Dr. W. M. Krogman, both outstanding speakers, will be on hand to help our group. With programs like these, membership is sure to grow in the Empire State.

North Carolina

Roy Lindahl writes that the First Annual Seminar was held in Charlotte on November 6-7 with Dr. Cecil Bliss of Sioux City, Iowa, as the featured clinician. Dr. Bliss has achieved national prominence in the field of practice administration. It was an excellent meeting. During the New York meeting, the Demeritt Pedodontic Study Club from eastern North Carolina presented a group table clinic and the North Carolina Unit was proud of their presentation. Members of the Study Club were Jim Lee, Mt. Olive; Zeno Edwards, Jr., Washington; Bill Hand, New Bern; Buck Barden, Wilmington; Matt Ansley, Warsaw; Lewis Lee, Wilson; Tom Fleming, Tarboro; Charlie Godwin, Rocky Mount; Ben Houston, Goldsboro, and Don Henson, Kinston.

The Unit congratulates the New York Unit for the outstanding job in arranging the ASDC meeting. It was truly great and from North Carolina, a big southern "thank you" for a job well done.

Ohio

Ohio's reporter, Dr. S. J. Scaravelli sent us a short report of what has been keeping them busy.

The Ohio Unit announces the formation of a new group, the Stark County Section of OSDC. Their officers are as follows:

President	Dr. Bernie McConnell
Vice-President	Dr. James Yonally
Secretary	Dr. Wm. Davenport
Treasurer	Dr. Dale Brogan

Dr. Paul Starkey, president of our Unit, has accepted a full-time associate professorship at his Alma Mater, the University of Indiana. He leaves us to take up working with Dr. Ralph McDonald. Sorry to see you go, Paul, but the best of luck.

The Cleveland Chapter is continuing its new policy of having an all day course for one of its meetings and will have Dr. Edward Cheney, noted orthodontist, speak on "Interceptive Orthodontics and Early Treatment in Mixed Dentition."

Oregon

In sending his report, Ted Norman says he knows no other State Unit can claim "such an auspicious beginning for their 1959-60 year" as his Unit. The reason . . . Dr. Evelyn Strange, Unit president, gave birth to her first daughter on

September 11, 1959. Linda joined three brothers to make up Dr. Strange's family. Congratulations, Dr. Strange. Don't know about other Units, but your Editor knows his Unit (Michigan) can't make such a claim.

Dr. Strange was so inspired that she almost singlehandedly arranged a special meeting for their Unit on October 4. Dr. Louis Baume, professor of Oral Pathology and Operative Dentistry at the University of Geneva, was guest speaker and had as his topic, "The Development of the Primary Dentition." Dr. Baume was in Portland as a guest of Dr. Harold J. Noyes, Dean of the Dental School.

An excellent program was provided at the meeting on October 21 at which time Dr. Benjamin Vidgoff, noted endocrinologist, lectured on "Endocrine Glands and Their Relation to Dentistry." His talk was most interesting and informative.

The November meeting promises to be a worthwhile one, too. Dr. Bertrum Kraus, Anthropologist and Head of Research in the Orthodontic department of the University of Washington, will speak on "Growth and Development" with special emphasis on dental development based on original research just completed.

You are so right, Ted—your Unit is off to a very good start.

Puerto Rico

A warm welcome is extended to our newest Unit to be admitted to the ASDC. Dr. Harold K. Addelston, past president of ASDC, presented the charter to Puerto Rico at the New York meeting.

Hope to hear from the Puerto Rican correspondent in time for the next quarter of the JOURNAL.

Rhode Island

This little state is a *busy* one. Dick Whelan sent in a copy of the entire program that has been planned for the year. Dr. Henry M. Goldman, director of the Riesman Dental Clinic, Beth Israel Hospital, Boston, was the speaker at the October meeting and presented what he called "An Atlas of Pathology in Children." This was made up of slides and commentaries on each of them which proved to be most interesting.

On November 2 the Unit had the privilege of hearing Dr. Wallace Gardner speak on "The Audio Analgesic System of Dental Anesthesia." Future commitments include a program given by Dr. Paul F. Sydow in February; Dr. Z. Konikow, president of the Michigan Society of Dentistry for Children and Unit News Editor, will speak at the March meeting on "The Management of Pedodontic Problems." The April meeting will feature Dr. John B. MacDonald, director of Forsyth Dental Infirmary and professor of Microbiology at the Harvard School of Dental Medicine. In May, Dr. Harold K. Addelston and Dr. Sidney Kronfeld will be on hand to give another one of their fine programs. Looks like a successful year for the Rhode Island Unit. Since their last report of the news, seven new members have increased their membership. Nice going, friends. By the way, their officers for the year are:

President ..... Lee C. Nathans
Vice-President ..... Herbert J. Underhill, Jr.
Secretary-Treasurer ..... Richard J. Whelan

Tennessee

Glad to hear from Tennessee this quarter. Joe Fuson sent in a copy of their newsletter which was interesting and newsy.

The Tennessee Unit held an additional state meeting on October 23-24 in Memphis with all ASDC members in Arkansas and Mississippi being invited to attend as guests.

Dr. Wm. E. Brown, associate professor of Pedodontics at the University of Michigan and president-elect of ASDC, was the clinician and spoke on "Traumatic Injuries"; "Treatment of Anomalies" and "Interceptive Orthodontics." Dr. Brown gave an excellent presentation on these subjects and had discussion groups with leaders from the members following his lectures. This was very stimulating.

There are now three active local Sections within TSDC with officers as follows:

Chattanooga—President ..... Bob Steel
Secretary-Treasurer, Carl Holmes
Memphis—President ..... Eddie Lande
Secretary-Treasurer .... Tom Pyron
Nashville—President ..... Willard Parker
Secretary-Treasurer .... Joe Wright

The Tennessee Society of Dentistry for Children was organized in Chattanooga in 1950 with Carl Sebelius, chairman pro tem. Their officers for 1959-60 are:

President ..... Bob Taylor
President-Elect ..... Earl Crumpton
Secretary-Treasurer ..... Jim McKnight

Texas

Terry E. Downs, Secretary-Treasurer and Reporter, sent in a brief news item.

Representing the Texas Unit at the recent National convention were Dr. James Simmons of Fort Worth, president-elect of the ASDC, Dr. Steiger from Houston, Dr. Raffkin, San Antonio, and Dr. Scott of Sherman, who is president of the Texas Unit.

Plans for the Spring program will be formulated at the Dallas Mid-Winter clinic in January 1960.

Virginia

Charlie Vincent from down Virginia way had little to report except to say that their Unit is making "big" plans for their Tenth Anniversary in 1960. Honoring all past presidents will be an important part of the program.

He also stated that the second printing of the pamphlet "Your Child and Better Dental Health" was a complete sell-out within two weeks after delivery and they are receiving orders for the third printing. You will recall this pamphlet was designed by a VSDC member, printed by the Unit, and made available to members at cost. It deals with dental caries and carbohydrate intake.

Washington

News from the Pacific Northwest! Correspondent Rolland Woofter states that the Spokane Pedodontic Seminar Group

Dr. Wm. Howard observing Dr. Maurice Bryant's hypnosis techniques on Arlene Baddley.

put on several very impressive table clinics on "Interceptive Orthodontics" for the Idaho Unit at the beautiful Shore Lodge on Payette Lake. The Unit meeting held in Yakima was most interesting with Dr. Maurice Bryant of Colfax as clinician. He spoke on "Hypnodontics" to a very intent and interested audience of dentists, wives and auxiliary personnel. Several in the audience reported the use of hypnosis to some degree and with excellent results.

The Fourth annual Northwest conference was held at Harrison Hot Springs, British Columbia, Canada, on September 24-27. Dr. Joseph Hartsook, associate professor of Dentistry at the University of Michigan, spoke on "Pulp Therapy." This meeting was an outstanding success.

Officers of the Washington Unit are:

President	James R. Condon, Spokane
President-Elect	Neil Beasley, Seattle
Secretary-Treasurer	John Parrish, Puyallup

Come again, Washington, long time—no hear!

Wisconsin

Fred A. Druse reported their Unit had a most interesting meeting on October 12 at the Hotel Mead, Wisconsin Rapids. A large group heard Dr. Gordon M. Jinks, president of the Vancouver Pedodontic Study Club and staff member of the University of Washington speak on "Quadrant Dentistry for Children"; "Radiography Technique"; "Patient Management With Fantasy and Hypnosis" and "Space Maintenance." Nine new members were welcomed into the Society at the meeting.

Plans are going forward for the Spring meeting to be held in Milwaukee during the annual convention of the Wisconsin State Dental Society. More about this later.

Pan American Council of Dentistry For Children

Al Anderson, Walter McBride and Sam Harris will be participating on the program at the Third Conference to be held in Bogota, Colombia, in February 1960.

This meeting will not only carry on the business of the Council but will also provide two or three days of table clinics and essays for the members.

Dr. Ben Gomez, president of the Pan American Council of Dentistry for Children in Bogota, is extremely interested in having men from the American Society of Dentistry for Children present clinics and essays at the meeting. Anyone interested in going to Colombia should write to: Dr. Benjamin Gomez Herrera, Carrera 13, No. 41-58, Bogota, Colombia, S. America, and he will place them on the program. By virtue of membership of the ASDC in the Pan American Council, every member of the ASDC automatically becomes a member of this group. Anyone attending would be more than happy with the presentations and with the wonderful reception they would receive from these very fine people in the Pan American countries.

For further information, write to Dr. Gomez as soon as possible.

Academy of Dentistry for the Handicapped

Fourteen members of the Academy of Dentistry for the Handicapped met at an informal luncheon during the recent American Society of Dentistry for Children sessions. Various items of business were discussed and the program for the

Academy's annual meeting in Chicago was announced. Dr. Manuel Album, the first president of this organization, was honored as he was elected a Fellow in the American College of Dentists.

The annual meeting will be held in Chicago at the Conrad Hilton Hotel on Sunday, February 7, 1960. This is the day before the opening sessions of the Chicago Mid Winter meeting. The scientific portion of the day's program is open to all interested dentists. Dr. Samuel Pruzansky of the University of Illinois Research Center will discuss the various disciplines in the oral rehabilitation of the handicapped patient. Drs. Robert Holle of Cincinnati and Robert Kirk of Springfield, Ohio will then show movie films dealing with the dental care of the handicapped.

The current officers of the Academy of Dentistry for the Handicapped are:

President .. Hugh M. Kopel, Detroit, Michigan
President-Elect, Max Bramer, Wheaton, Illinois
Secretary-Treasurer .....
..... Robert Kaplan, Camden, New Jersey

Kenneth A. Easlick Graduate Society

This past Spring, Ann Arbor was host to the Kenneth A. Easlick Graduate Society, the second such conference to be held there. It was attended by over thirty graduate pedodontists of the University of Michigan and their guests from all corners of the United States, Mexico and Canada.

The main clinician for this three-day meeting was Dr. Samuel Pruzansky, associate director of the Cleft Palate Clinic of the University of Illinois. Dr. Pruzansky presented two outstanding lectures to the group: "Abnormal Patterns of Cranio-Facial Development" and Cephalometric Roentgenography for the Pedodontist."

The program also included a discussion on "Interceptive Orthodontic Diagnosis" by Dr. Frank Popovich, Burlington, Ontario; research reports by students of Dr. Easlick's graduate program, and a variety of lectures by members of the faculty of the University.

A most interesting and informative innovation was put into effect at this meeting, i.e. panel discussions involving groups of members of the Society exchanging ideas on everyday problems in the practice of pedodontics. The participating men and audience all felt that these presentations were of inestimable value.

Dr. Mel Noonan, outgoing president of the Society, was his usual humorous self as master of ceremonies at the banquet which honored Dr. Easlick.

Dr. Noonan presented an Honorary membership to Dr. Pruzansky for his valuable contribution to the Society and announced the following slate of officers for the coming two years:

President	Samuel Stulberg
President-Elect	Zalman Konikow
Secretary-Treasurer	Laren Teutsch
Councilmen	Paul Sydow
	Bernard Smith
	Hugh Kopel

News Flash

As an extra news flash for all of Kenneth A. Easlick's former students and friends, the "Chief" won a Distinguished Faculty Achievement Award on Monday, Oct. 5, 1959. This should be of special interest to all members of the Kenneth Easlick Graduate Society who were at the 1959 meeting and signed the testimonial which was then submitted to the evaluating committee. We are proud that we have had another opportunity to say "thanks" to this really great "guy."

Achievement Award*

On Monday evening, October 5, 1959, Dr. Kenneth Alexander Easlick received one of five Distinguished Faculty Achievement Awards presented by the Development Council of the University of Michigan. These awards are presented annually to the five University teachers, from any school or campus, who have excelled in the teaching and counselling of students and in service to the University. Of particular note, is the fact that Dr. Easlick is the first member of the faculty of the School of Dentistry ever to receive this award.

Dr. Easlick is professor of Dentistry and professor of Public Health Dentistry and head of the Department of Dentistry for Children.

In receiving this high award, Dr. Easlick was cited as "known internationally for his contributions to research, particularly in pedodontics, and a recognized leader in the field of public health dentistry."

Because of his many and diversified accomplishments, it would be difficult to enumerate them but, perhaps, the attributes that weighed the heaviest in his selection for the Award are his abilities to stimulate students and his knack for counselling them. His students know him for his kindly but firm approach. He asks for perfection, but will settle for the best a student is capable of producing. His abilities to teach students to read critically and write in a scientific manner are well known. The exacting strokes of his red pencil are remembered by all those who have submitted papers to him for appraisal. For his great contributions to dentistry, we salute him.

* This article appeared in the November issue of the *Journal of the Michigan State Dental Association*.

American Academy of Pedodontics

The Twelfth annual meeting of the American Academy of Pedodontics was held at the Hotel Commodore, New York City on Sept. 8-11, 1959. Harold K. Addelston presided at the banquet in honor of President Maury Massler.

Dean Raymond J. Nagle, from New York University, College of Dentistry, extended a warm welcome to all members and their guests. The essayists during the three-day meeting were: Dr. Samuel Pruzansky, associate professor of Orthodontics, University of Illinois, College of Dentistry, whose topic was "Present Status of the Management of the Patient With Oral Clefts"; Dr. Joseph Gary, Rockefeller Plaza, New York City, who spoke on "A Survey of the Status of Dentistry for Children in Russia"; and Dr. Herbert Koepp-Baker, professor Emeritus of Speech Pathology, University of Southern Illinois.

Research reports were given by Academy members and their guests during the three-day meeting with Ralph Ireland presiding. Also, of interest were the reports from Study Groups and Individuals which were under the direction of Dr. Wm. E. Brown.

Maury Massler presented the following slate of officers after which he was

given a standing ovation by the members for his untiring efforts as president:

President	Joseph T. Hartsook
President-Elect	George W. Teuscher
Vice-President	William F. Cody
Secretary-Treasurer	James H. Simmons

Ben Kletsky and William P. Humphrey have been appointed Local Arrangements chairmen for the 1960 meeting in Denver.

Many thanks to Harold Addelston and his "gal Friday" for their efforts in making the 12th meeting a successful as well as an enjoyable one.

Announcements

Word comes from the graduate division of Baylor University College of Dentistry in affiliation with the Children's Medical Center, Dallas, that classes in graduate pedodontics will begin in September 1960. The program is a two-year full-time course utilizing both the facilities of Baylor University and those of Children's Medical Center. The degree of Master of Science in Dentistry will be awarded upon successful completion of the requirements. The Children's Medical Center provides tuition and other University fees and a stipend of $150 per month plus room and meals for two students.

* * *

Applications and further information can be obtained by writing to Dr. John J. Murray, Jr., Chairman, Department of Pedodontics, Baylor University College of Dentistry, 800 Hall St., Dallas, Texas.

* * *

A series of postgraduate courses will be offered by the Emory University School of Dentistry, Georgia, among which is one to be given on March 2-4, 1960 on "Dentistry for Children." Further information can be secured by writing directly to Dr. Ernest L. Banks, director of postgraduate education, Emory University, Atlanta, Ga.

* * *

A course on "Preventive Orthodontics for the General Practitioner" will be presented by Dr. Sidney I. Kohn, professor of the Department of Pedodontics, Fairleigh Dickinson University School of Dentistry, on December 10-11, 1959 at the University of Nebraska. For further information, write to John B. Cronland, University Extension Division, University of Nebraska, Lincoln 8, Neb.

* * *

Postgraduate courses that will be offered at the W. K. Kellogg Foundation Institute, University of Michigan, are: Dental Treatment for Handicapped Children on March 14-15, 1960; Dentistry for Children on February 15-26, 1960 and May 23-June 3, 1960. Both of the courses will be under the direction of Drs. Easlick, Hartsook and Brown. For further details write to: Dr. Wm. R. Mann, associate director of W. K. Kellogg Foundation Institute, University of Michigan, Ann Arbor, Mich.

* * *

Northwestern University Dental School offers a postgraduate course in Pedodontics on February 11, 12, 1960. The faculty for this course will include Dr. Harold K. Addelston, New York University, Drs. Geo. W. Teuscher, Norman H. Olsen, Chas. R. Carpenter, Sheldon W. Rosenstein and Dr. Judith Wood, Children's Hospital, Chicago, Ill. For further information, address the Office of Admissions, Northwestern University Dental School, 311 E. Chicago Ave., Chicago 11, Ill.

Postgraduate Conference

The 9th Annual Postgraduate Conference of the Southern California Society of Dentistry for Children will be held on February 21-24, 1960, at Palm Springs, California. Dr. Robert Moyers, University of Michigan, will be the main speaker.

For further information, please write to: Miss Lorraine Duncan, 3780 Wilshire Blvd., Los Angeles 5, California.

If you have any information on other available courses which would be of interest to members of the ASDC, please forward to your Unit News Editor.

California—Here We Come!

The American Society of Dentistry for Children meeting in 1960. PLACE: Ambassador Hotel, Los Angeles, California.

Are you ready for '60? If not, start making your plans now. Southern California is planning an interesting meeting and the entertainment committee is going all out to offer an enjoyable three days for you and your family. As always, there is a housing problem so when reservations become available, return yours promptly.

General Chairman is Mode R. Perry who has appointed the following chairmen to assure you nothing will stop them from giving you a wonderful meeting and enjoyable time:

Arrangements Chairman ..... John R. Kennedy, Reseda, Cal.
Banquet Chairman ..... Albert L. Anderson, San Diego, Cal.
Budget Chairman .... Geo. J. Higue, Bell, Cal.
Family Entertainment ..... Dr. and Mrs. James J. Leib, Sherman Oaks, Cal.
Publications Chairman ..... Wm. E. Allen, Pasadena, Cal.
Publicity Chairman ..... Robert C. Read, Los Angeles, Cal.
Registration and Hospitality ..... Francis W. Summers, Los Angeles.
Scientific Program Chairman ..... Hugo M. Kulstad, Bakersfield, Cal.

CALIFORNIA—1960!

Material intended for Unit News should be sent to Tiny Konikow, 500 S. Washington Ave., Royal Oak, Michigan. Deadline dates are: First Quarter, February 25; Second Quarter, April 25; Third Quarter, July 25; Fourth Quarter, October 25.

Bioassay of Cavity Liners Under Silicate Cement Fillings in Rat Incisors

APHRODITE PAPPAS, D.D.S., AND MAURY MASSLER, D.D.S., M.S.*

INTRODUCTION

SILICATE cements are highly acid and produce undesirable pulpal reactions. The use of a cavity liner or base to protect the pulp is therefore essential. Many cavity liners are available commercially but as far as we could determine, only two or three of these have been subjected to testing *in vivo*. The purpose of this study was to investigate the effectiveness of a number of cavity liners under silicate cement fillings placed in incisors of albino rats.

REVIEW OF LITERATURE

Silicate cements are used exclusively in the anterior teeth because of superior esthetic properties, in spite of very inferior physical qualities. Silicate cements are soluble in saliva, can withstand only minor stresses and their marginal sealing quality is very poor (Skinner, 1954). However, recurrence of caries is remarkably low (Phillips and Swartz, 1957).

The researches of Pallazzi (1923), Fasoli (1924), Manley (1950), and Gurley and Van Huysen (1937, 1940) on dogs' teeth showed quite clearly that silicate cements cause severe pulpal reactions. Manley (1941), Zander (1946) and Shroff (1946) demonstrated similar injuries to the pulp in human teeth. The degree of injury depended on the patient's age, length of time that the filling had been in place, size of the filling and depth of the cavity. Pulpal change began with inflammation and was followed by degeneration of odontoblasts, dentin hypoplasia, abscess formation and necrosis. Zander (1946), Manley (1950), and Shroff (1946, 1952) have also demonstrated that the so-called "improved" silicate cements still produce undesirable reactions in the pulp.

It is quite clear that the pulpal injury is caused by the residual orthophosphoric acid in the cement (Harvey, LeBrocq and Rakowski, 1944). Perreault et al. (1956) showed that phosphoric acid liquid applied to cavities in rat incisors produced essentially the same changes as did the cements. Harvey, LeBrocq and Rakowski (1944) gave good evidence to indicate that free acid may be present within the gel of a silicate cement for as long as one month.

To protect the pulp, many types of cavity liners have been made available to the dentist. Some of these are film-forming agents or varnishes such as copal, nitrocellulose, resin or sandarac in an appropriate solvent such as acetone, benzene, alcohol or acetates of the lower alcohols. These varnishes are thought to act as insulators and to seal the dentinal tubules. Zander and Pejko (1947) found that the copal resin type of cavity varnish extensively used in dental practice under silicate cements was ineffective in protecting the pulp. Zander and Pejko (1947) showed that calcium hydroxide and zinc oxide suspended in a solution of polystyrene in

* Department of Pedodontics, University of Illinois College of Dentistry, Chicago 12, Illinois.

chloroform* was much more effective in protecting the pulp against the action of silicate. Silberkweit et al. (1955) confirmed this conclusion by using Chembar under black copper cements placed in cavities prepared in the incisor teeth of rats.

In recent years, a number of liners in which calcium hydroxide is dispersed in a quick setting medium and which are intended for use under silicate cements have appeared on the dental market. Only two of these, Chembar and Pulpdent Paste** (Berk, 1950) have actually been examined histologically. The purpose of this study was to test the efficiency of a number of cavity liners in preventing pulpal damage under silicates placed in cavities prepared in the incisor teeth of rats.

Methods and Materials

Many investigators have stressed the need for more rapid and less expensive methods of testing the effect of filling materials and drugs on the pulp. Mohammed and Schour (1953) suggested a method of preparing a cavity in the incisor of the albino rat for the purpose of testing the effects of medicaments and fillings on the pulp. The method was further developed by Silberkweit, et al. (1955) and by Perreault, et al. (1956).

Technical Procedure

The rat was anesthetized by an intraperitoneal injection of 0.5 cc. of a 1 per cent solution of sodium pentobarbital per 150 grams of body weight.

Cavity preparation. A cavity was prepared with the aid of a binocular dissecting microscope on the lateral aspect of the left mandibular incisor. A cavity approximately 2.0 mm. in diameter and 0.75 mm. in depth was first prepared in the bone just anterior to the mental foramen using the No. 4 end-cutting bur. When the periodontal membrane was reached hemorrhage was usually profuse. This was controlled by sponging and the dentin was exposed. A cavity was then prepared in the dentin. Every precaution was taken to make the cavity approximately 0.75 mm. in diameter and half the distance from the pulp using a No. 2 end-cutting bur or a No. 33½ inverted cone bur.

Filling procedure and materials. After carefully cleaning the dentinal cavity of blood and debris by the use of water and air, the test liner was applied and allowed to set. The cavity was then filled with S. S. White Filling Porcelain. After the filling had set, it was covered with a layer of wax equal to the thickness of periodontal membrane to prevent ankylosis. The cavity in the bone was filled with Aquadont* or zinc oxide and eugenol paste.

Duration of experiment. All animals were sacrificed after 7 days.

Histologic preparation. The mandible containing the lower incisors was dissected immediately after the sacrifice and fixed in 10 per cent neutral formalin or Zenker's solution. The specimens were decalcified in 5 per cent nitric acid for 48 hours, embedded in paraffin or celloidin and cut in cross or longitudinal sections. Some sections were cut on a freezing microtone at 12 microns, using carbon dioxide gas. The sections were

* Marketed as Chembar by the L. D. Caulk Co., Milford, Del.

** Marketed by the Rower Dental Mfg. Corp., Boston, Mass.

* Aquadont is composed of zinc oxide 200.0, zinc sulfate 100.0 and cornstarch 100.0. This powder sets rapidly when mixed with water.

stained routinely with hematoxylin-eosin. Every tenth section was stained with Mallory's triple connective tissue stain. The non-operated right lower incisor was used as a control in each animal.

For this investigation 106 experimental teeth (left mandibular incisors) and 106 unoperated contra-lateral control teeth (right incisors) were used in 106 animals.

The experimental teeth were treated as follows before filling with silicate cement:

	No. Teeth
No liner used (controls)	20
Copalite varnish (H. J. Bosworth Co., Chicago, Ill.)	15
Cal-Drox (American Consolidated Mfg. Co., Philadelphia, Pa.)	6
Handi-Liner (Mizzy Inc., Clifton Forge, Va.)	3
Calcium hydroxide powder (C. P.) mixed with water	5
Epoxy resin (Shell Chem. Co., Los Angeles, Calif.)	3
Pulpdent Liquid (Rower Dental Mfg. Corp., Boston, Mass.)	6
Pulpdent Paste (Rower Dental Mfg. Corp., Boston, Mass.)	5
Phenol 95 per cent (applied for 3 minutes to "seal" the dentinal tubules)	12
Chembar (L. D. Caulk Co., Milford, Del.)	12
Zinc oxide and eugenol (thick mix)	19
	106

Method of Analysis

The distance between the floor of the cavity and the original pulpal surface was measured along the dentinal tubules and recorded as being shallow, medium or deep; shallow, less than ¼ of dentin removed; deep, less than ¼ of dentin remaining over the pulp.

The effects of the silicate cement fillings and the liners were assessed by analysis of the character and amount of postoperative dentin formed by the odontoblasts, destruction of the odontoblasts and inflammation of the pulp according to the method outlined by Silberkweit, et al. (1955) and outlined in table 1.

Findings

In many sections, connective tissue cells were observed growing into the margins and floor of the cavity between the silicate cement and the dentin. These originated from the periodontal membrane and gave a picture very similar to that reported by Zander (1957) and Jensen and Zander (1958). Since the presence of such cells between the silicate and the dentinal tubules might modify the reaction of the odontoblasts to the silicate, they were omitted from the study. However, the frequent occurrence of this phenomenon indicates a basic fault in the marginal sealing properties of this type of filling material.

Unlined Silicate Cement Fillings. The pulpal reactions under the unlined sil-

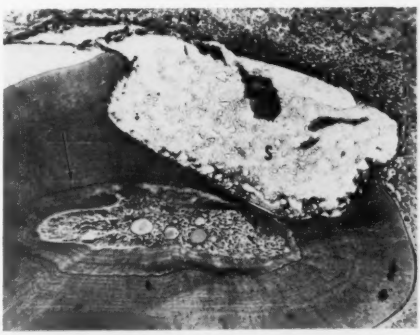


Figure 1. Photomicrograph of a cross section through a rat incisor with a deep cavity filling with silicate cement (no liner). Note the calciotraumatic line (arrow) formed at the time of operation 7 days before sacrifice. Note the severe hypoplasia of the postoperative dentin under the medium portion of the cavity (moderate reaction) and the apasia and pulpal necrosis under the deepest portion (severe reaction). S, silicate cement. (Celloidin section, H. & E., x 38).

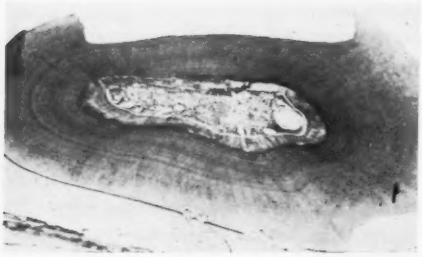


FIGURE 2. Photomicrograph of a cross section through a rat's incisor with a medium cavity lined with a layer of Cal-Drox and filled with silicate cement. Note the severe hypoplasia of the postoperative dentin under the cavity and on the opposite pulpal wall (severe reaction). (Frozen section, H. & E., x 38).

icate cement fillings were very similar to those already described by Silberkweit, et al. (1955) and Perreault, et al. (1956) in rat incisors and by Zander (1946), Manley (1950), and Shroff 1946) in human teeth.

Under shallow cavities there was sometimes, but not always, a mild hypoplasia of the postoperative dentin with disarrangement of the odontoblasts in that area, but no observable effects in the pulp itself (table 1).

Under medium cavities, postoperative dentin hypoplasia with destruction of odontoblasts was fairly consistent. In most specimens, but not in all, there was also a mild degree of inflammation pres-

FIGURE 3. Photomicrograph of a cross section through a rat incisor with a medium cavity lined with Copalite varnish (applied in two layers) and filled with silicate cement. Note the hypoplasia of the postoperative dentin under the cavity (moderate reaction). The pulp shows shrinkage artefacts due to processing. (Celloidin section, H. & E., x 38).

TABLE 1

PULPAL REACTIONS UNDER SILICATE CEMENT

No Reaction	= Faint calcio-traumatic line visible at the junction of the pre- and post-operative dentin (level of dentin forming at the time of operation). Post-operative dentin normal in quantity and quality.
Mild Reaction	= Calcio-traumatic line accentuated but no effects visible on odontoblastic layer, postoperative dentin formation or calcification. Occasional localized hypoplasia.
Moderate Reaction	= Calcio-traumatic line very prominent under cavity preparation; odontoblastic layer disrupted; postoperative dentin formation hypoplastic; sub-odontoblastic hyperemia and round cell infiltration.
Severe Reaction	= Calcio-traumatic line very prominent; odontoblastic layer completely disrupted or absent; postoperative dentin formation under cavity preparation almost entirely absent with area opposite cavity preparation also hypoplastic; pulp hyperemic with prominent round cell infiltration.
Very Severe Reaction	= Same as above plus hemorrhage in the pulp with abscess formation or necrosis of pulp under the cavity preparation.

TABLE 2

EFFECTIVENESS OF VARIOUS LINERS UNDER SILICATE CEMENT FILLINGS PLACED IN RAT INCISORS

LINER USED	DEPTH OF CAVITY	NO. OF SPECS.	*Pulpal Reaction*				
			NONE	MILD	MODERATE	SEVERE	VERY SEVERE
None	Shallow	3		2	1		
	Medium	14		4	6	4	
	Deep	3				1	2
Copalite Varnish	Shallow	5		5			
	Medium	10		6	2	2	
Cal-Drox	Medium	2			1	1	
	Deep	4		2	1	1	
Handi-Liner	Shallow	1		1			
	Medium	2			2		
Epoxy Resin	Medium	3		1	2		
Calcium Hydroxide	Medium	1		1			
	Deep	4		3	1		
Pulpdent Paste	Medium	4		2	2		
	Deep	1			1		
Pulpdent Liquid	Medium	5		4	1		
	Deep	1				1	
Phenol 95%	Shallow	1	1				
	Medium	11	7	2	2		
Chembar	Medium	11	3	8			
	Deep	1				1	
Zinc Oxide-Eugenol	Shallow	6	6				
	Medium	7	6	1			
	Deep	6	4	2			

ent in the pulp under the cavity area (figure 1 and table 2).

Under deep cavities, hypoplasia of postoperative dentin, destruction of odontoblasts and pulpal inflammation were constant findings. In some specimens, abscess formation could be observed within the pulp.

When the cavity was very deep (less than 12 microns of dentin remaining) hemorrhages were also present in the pulp.

Effectiveness of Various Liners. An exact quantification of the effectiveness of the various liners could not be established because of wide variations in cavity depths (from shallow to deep) and because of variations in pulpal reactions in specimens of equivalent depths. The number of specimens at each cavity

FIGURE 4. Photomicrograph of a cross section through a rat incisor with a deep cavity lined with a layer of Pulpdent Paste and filled with silicate cement (moderate reaction). Note the hypoplasia of the postoperative dentin under the cavity. Arrow points to the calcio-traumatic line caused by the operation. Artefacts in pulp due to shrinkage. (Frozen section, H. & E., x 38).

depth were often too few to be certain that the characteristic pulpal reaction had been obtained. However, it was possible to evaluate the *relative* effectiveness of the different liners.

Zinc oxide-eugenol base provided the most complete protection to the pulp. This confirms previous findings by Shroff (1946) and by Manley (1950). Sixteen of the 19 specimens including 6 with deep cavities showed no pulpal reaction (table 2). The histological picture was the same as in the unoperated control teeth. However, a deep yellow staining of the silicate cement was quite obvious.

All of the liners used showed some tendency to reduce the severity of the pulpal reaction (table 2). Some liners caused a distinct shift in the number of specimens to the left (in table 2) but some specimens still showed severe reactions similar to those seen under unlined specimens. These were designated as showing *moderate protection*. In this group were Cal-Drox (figure 2), Copalite varnish (figure 3), Handi-Liner and an epoxy resin.

Another group was designated as showed no reactions (table 2), in spite pulpal reactions under medium and deep

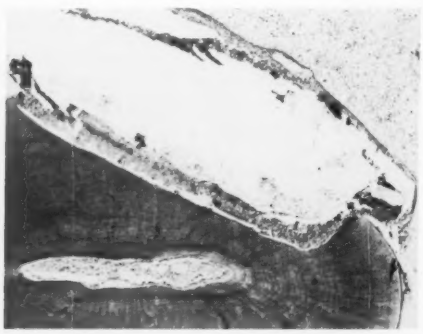


FIGURE 5. Photomicrograph of a cross section through a rat incisor and a medium cavity lined with Pulpdent Liquid and filled with silicate cement. Note the hypocalcified layer of postoperative dentin and mild hypoplasia under the deep portion of the cavity (moderate reaction). (Celloidin section, H. & E., x 38).

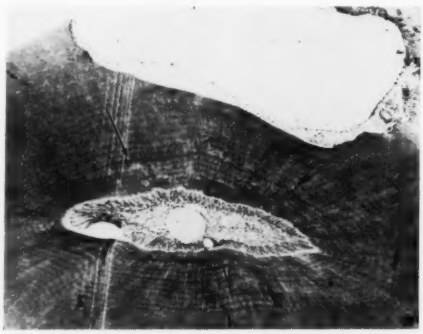


FIGURE 6. Photomicrograph of a cross section through a rat incisor with a medium cavity lined with Chembar and filled with silicate cement. The pulp is normal and the postoperative dentin under the cavity is normal in quantity and quality. Note the slightly accentuated incremental line (arrow) which reflects the trauma of the operation at 7 days prior to sacrifice. Seven incremental layers are visible in the postoperative dentin. (Celloidin section, H. & E. x 38).

cavities were considerably reduced in severity when compared with unlined cavities. This group included calcium hydroxide paste, Pulpdent paste (figure 4) and Pulpdent liquid (figure 5).

A surprising number of specimens treated with phenol for 3 minutes showed on reactions (table 2), in spite of the ability of this drug to penetrate rapidly through the dentin as evidenced by the altered staining reaction of the dentin to which it was applied. Phenol, Chembar (figure 6) and zinc oxide-eugenol were designated as showing *very good protection.*

Discussion

The results obtained in this series should not be translated to the clinical situation and human teeth because the rat incisor differs from human teeth in many ways. Clinical observations suggest that *all* of the liners tested in this series have been effective in protecting the human pulp against the noxious action of the acid silicate. This may be due to the much greater thickness of dentin under the floor of most cavity preparations in human teeth and the lesser permeability of human dentin. This study attempts only to compare the *relative* effectiveness of liners in a test situation under laboratory conditions. Although the number of specimens observed in each group was small, the results obtained should be provocative to the clinician and lend caution to the claims made by the manufacturers.

This study showed that the bioassay of filling materials and liners is a simple and reproducible procedure when the rat incisor in used as the test object. It is hoped that dental manufacturers will adopt this method of evaluating their products *in vivo*—or at least support research laboratories using such methods of bioassay.

Effect of Phenol 95 per cent. Phenol is often used on the premise that it coagulates the surface of the protoplasmic contents of the freshly cut dentinal tubules and thus provides a barrier against the ingress of acids from silicate cement. Amler and Bevelander (1951) and Martin (1951) have thrown considerable doubt on this premise. They showed that phenol (as well as alcohol and many other substances) *opened* the tubules and *increased* tubular penetration to dyes and isotopes. In this study, the application of phenol resulted in considerable protection against the injurious action of the acid from the silicate cement. A striking observation was that the dentin matrix under the cavity preparation to which phenol was applied showed an altered staining reaction.

Summary and Conclusions

It is generally agreed that the acid present in silicate cement fillings is potentially damaging to the dental pulp. A number of liners and bases have therefore been suggested for use under silicate cement restorations for the protection of the pulp. Few of these have been tested histologically and as far as we can determine no attempt has been made to compare these experimentally. This study compared a number of cavity liners by placing them under silicate cement fillings in rat incisors. The results were interesting and provocative. They showed that zinc oxide-eugenol was most effective as a base, although it discolored the restoration deeply. A polystyrene type of liner containing calcium hydroxide was superior to the other liners containing calcium hydroxide. The thin

film forming agents were less effective in protecting the pulp.

It is hoped that this or similar methods for the bioassay of fillings and liners will be used by manufacturers to test their products *before* placing them on the market. Such research might lead to better cavity liners, and perhaps also to better silicates.

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We wish to acknowledge our appreciation to Mr. William M. Winn for the preparation of the photomicrographs presented in this paper.

BIBLIOGRAPHY

1. AMLER, M. H., and BEVELANDER, G.: Dentin Permeability to Radioactive Phosphorus After Specific Time Intervals Following the Application of Various Drugs. New York D. J. 21:295, Aug.-Sept. 1951.
2. BERK, H.: The Effect of Calcium Hydroxide-Methyl Cellulose Paste on the Dental Pulp. J. D. Children 17:65, Dec. 1950.
3. FASOLI, G.: Silikatcement und Pulpa Veranderungen. Zeitschrift. fur Stomatologie 22:222, April 1924.
4. GURLEY, W. B., and VAN HUYSEN, G.: Histologic Changes in Teeth Due to Plastic Filling Materials. J.A.D.A. 24:1807, Nov. 1937.
5. HARVEY, W., LEBROCQ, D. F., and RAKOWSKI, L.: Acidity of Dental Cements. Brit. Dent. J. 77:61, Aug. 1944.
6. JENSEN, J. R., and ZANDER, H. A.: Effect of Two Cementing Materials on the Gingival Tissues. North-West Den. 37:210, July 1958.
7. MANLEY, E. B.: Effect of Filling Materials on the Human Tooth Pulp. Proc. Roy. Soc. Med. (Sect. Odont.) 34:693, April 1941.
8. MANLEY, E. B.: A Review of Pulp Reactions to Chemical Irritations. Internat. D. J. 1:36, Dec. 1950.
9. MARTIN, N. D.: The Permeability of Dentin to P^{32} Using the Direct Tissue Radioautography Technique. Oral Surg., Oral Med., Oral Path. 4:1461, Nov. 1951.
10. MASSLER, M.: Effects of Filling Materials on the Pulp. J. Tennessee D. A. 35:353, Oct. 1955.
11. MOHAMMED, C. I., and SCHOUR, I.: Experimental Cavity Preparations in the Incisor of the Rat: Effects of Fillings With Paraformaldehyde. J. D. Res. 34:608, Aug. 1953.
12. PALAZZI, S.: Die Anatomischen Veranderungen der Zahnpulpa in Gefolge von Silikatcement Fullungen. Zeitschrift. fur Stomatologie 21:379, May 1923.
13. PERREAULT, J. D., MASSLER, M. and SCHOUR, I.: Reaction of Odontoblasts to Medicaments Placed in Cavity Preparations in Rat Incisors. J.A.D.A. 52:533, May 1956.
14. PHILLIPS, R. W., and SWARTZ, M. L.: Effect of Certain Restorative Materials on Solubility of Enamel. J.A.D.A. 54:623, May 1957.
15. SHROFF, F. R.: Effects of Filling Materials on the Dental Pulp. New Zealand D. J. 42:99, July 1946; 42:145, Oct. 1946; 43:35, Jan. 1947
16. SHROFF, F. R.: Effects of Filling Materials on the Dental Pulp. A Critical Review. J. D. Educ. 16:246, Nov. 1952.
17. SILBERKWEIT, M., MASSLER, M., SCHOUR, I., and Weinmann, J. P.: Effects of Filling Materials on the Pulp of the Incisors of the Rat. J. D. Res. 34:854, Dec. 1955.
18. SKINNER, E. W.: The Science of Dental Materials. 4th ed., W. B. Saunders Co., Phil. 1954, pp. 152-168.
19. ZANDER, H. A.: The Reaction of Dental Pulps to Silicate Cement. J.A.D.A. 33:1233, Oct. 1946.
20. ZANDER, H. A.: Effect of Silicate Cement and Amalgam on the Gingiva. J.A.D.A. 55:11, July 1957.
21. ZANDER, H. A., GLENN, J. F., and NELSON, C. A.: Pulp Protection in Restorative Dentistry. J.A.D.A. 41:563, Nov. 1947.
22. ZANDER, H. A., and PEJKO, I.: Protection of Pulp Under Silicate Cements With Cavity Varnishes and Cement Linings. J.A.D.A. 34:811, June 1947.

Orthodontic Rehabilitation

GEORGE V. NEWMAN, D.D.S.

RESTORING an individual's dentofacial complex to acceptable function, stability, and aesthetics may require the interdependent roles of the general practitioner, oral surgeon, and the orthodontist, as the following case report portrays.

HISTORY OF THE PATIENT

The patient, S. L., an eleven year old white male, first presented himself to the referring dentist. The parents of the patient complained that he never smiled —probably due to a long-standing self-consciousness about his dentofacial deformity. It was evident that both dental care and personal oral hygiene had been sorely neglected because of two factors: a lack of dental education and family economics.

EXAMINATION OF THE PATIENT, X-RAYS, AND PHOTOGRAPHS

The maxillary left first molar was removed prior to my seeing the patient due to a carious exposure. X-ray examination revealed extensive dental caries in the remaining maxillary and mandibular first molars.

An erupted supernumerary peg shaped tooth was present between the maxillary right lateral and left central incisor. The x-rays also showed two other supernumerary teeth (mesiodens*) and an impacted right central incisor[1] (Figs. 1 and 2). One mesiodens lay horizontally in the palate, resting upon the impacted right central incisor. The second mesiodens was to the left of the midline in a vertical position adjacent to the root of the left central incisor. Apparently, the three supernumerary teeth prevented the right central incisor from erupting.[2]

Intraoral x-rays revealed the presence of the maxillary and mandibular third molar buds. Photographs showed a maxillary protrusion, while the mandible seemed slightly distal to its normal position to cranial anatomy.

Right FIGURE 1 Left

* Mesiodens, according to Kronfeld, are supernumerary teeth which can be found near the mid-line, located either in the bone above the roots of the central incisors or erupted behind the central incisor teeth.

Left FIGURE 2 Right
After extraction of erupted supernumerary.

ORTHODONTIC EXAMINATION

The examination of the patient's dentition and study models indicated a Class II (Angle) molar relationship. However, the blocked-out right cuspid and right central incisor, as well as the crowding and protrusion of the left side of the anterior segment, pointed to a mesial migration of the buccal segments due to the break in contacts resulting in a shortened arch length (Fig. 3).

Measurements of the required maxillary arch length as compared to the available maxillary arch length showed a discrepancy of 12.5 mm., confirming the discrepancy in the arch length.

The mandible was well developed, but there was slight crowding of the anteriors, as well as carious exposures of the lower first molars.

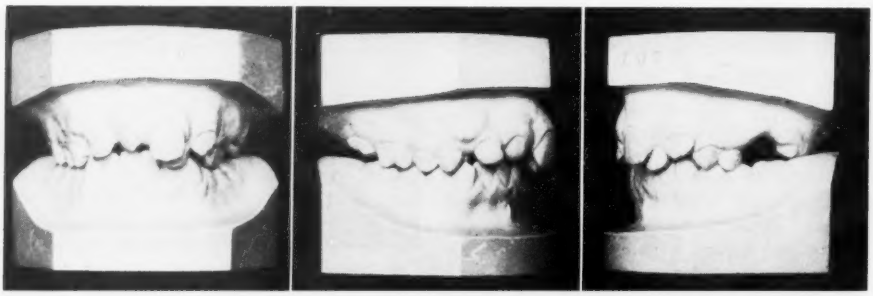
DIAGNOSIS

The malocclusion was due to one erupted and two embedded mesiodens, causing the impaction of the upper right central incisor, a maxillary bilateral mesial drifting of the buccal segments, protrusion of the left central incisor, malalignment of the left lateral incisor and cuspid, and finally a blocking out of the upper right cuspid.

TREATMENT

After the general practitioner had restored all the carious teeth present, the patient was referred to an oral surgeon for the removal of the three supernumeraries.

Since the upper left first molar had been extracted previously, and further dental treatment revealed carious ex-



A B C
FIGURE 3

posures in the remaining first molars, the oral surgeon was instructed to remove the three remaining first molars.

The spaces created by the removal of the maxillary first molars would be used to reposition the buccal and anterior segments, and create space for the unerupted central incisor. The spaces in the mandible created by the removal of the lower molars would be employed to align the crowded lower anteriors.

After the oral surgeon had completed his treatment (Fig. 4), the patient was given an upper bite plate and a lower lingual arch to maintain space until the

Right FIGURE 4 Left

insertion of the multibanded appliance.

The vicissitudes of life occasionally alter the original treatment to conform with reality. Unfortunately, the patient's father became mentally ill, and the boy was unable to continue treatment.

The patient finally returned for further orthodontic treatment about ten months later—minus the bite plate and the lower lingual arch. The maxillary second molars had drifted forward almost closing the space created by the removal of the first molars.

A reevaluation of the case indicated that to provide room for the unerupted

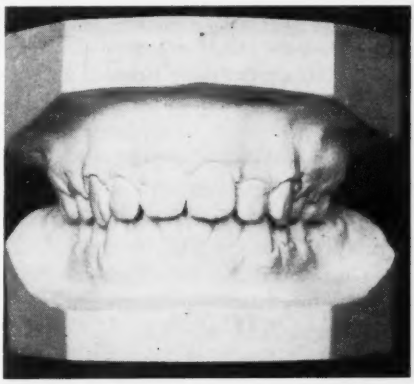


FIGURE 5

right central incisor and align the remaining anteriors, it would be necessary to remove the maxillary first bicuspids.

Prior to the removal of the first bicuspids the upper and lower archés were completely banded with the edgewise appliance. The maxillary cuspids were then moved distally into the first bicuspid spaces while the lower second molars were brought into contact with the lower second premolars. Space was created for the eruption of the upper right central incisor. The right central incisor erupted as soon as sufficient space was created for its mesio-distal width, but it erupted severely rotated. The right central incisor was rotated over 180°, the protruding left central incisor

FIGURE 6

was retracted, the left lateral incisor which had half its labial surface covered by the left central was aligned, and the cuspids were guided to proper position. The second molars were placed in Class II molar relationship rather than extract two lower bicuspids.

The dentition after removal of the appliances is shown in Figure 5. Note the concave enamel defect on the labial of the upper right central incisor caused by the mesiodens.

Two and one half years after retention, the patient's general dentist placed an acrylic jacket on the right central incisor (Fig. 6).

Conclusions

The diagnosis, plan of treatment, and treatment objectives, beset with extraneous familial and economic problems were finally overcome, and the results achieved.

Perfection was not obtainable in this case; nevertheless, an adequate improvement is obvious. The orthodontist can only work with the material given to him; perfection was not possible.

The stability of this case over a three year period validates the leaving of the second molars in a Class II molar relationship. One can only speculate on the decreased severity of the malocclusion had the three supernumeraries been removed at an earlier time.[3]

The teamwork of the general dentist in referring the patient as soon as he recognized the malocclusion, restoring extensive dental decay, and inserting the final aesthetic "touch" with his acrylic jacket, the oral surgeon in skillfully removing the mesiodens, and the orthodontist in creating an acceptable alignment and occlusion, played an important role in restoring this young man's psychological outlook on life. Certainly, his opportunities for employment have been improved.

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Bibliography

1. Kronfeld, Rudolph. Histopathology of the Teeth and Their Surrounding Structures, Lea & Febiger, Philadelphia, Pennsylvania, p. 24, 1939.
2. Douglas, B. and Kresbery, H. Mesiodens. Dental Radiography and Photography, 30:4, p. 70, 1957.
3. Newman, G. V. Prevalence of malocclusion in children six to fourteen years of age and treatment in preventable cases. J.A.D.A. 52:566-575, May 1956.

The Effect of Antisialogogues on Children

W. Neal Newton,* D.D.S. and Richard D. Morrison,** D.D.S.

THE modern dentist is greatly concerned with salivation and numerous studies verify this concern. Salivation interferes with many dental manipulations since most dental procedures excite a copious flow of saliva.[1] Sialism is a major problem in dentistry for children.[2] The use of the rubber dam, for example, stems from the need for a dry field and the difficulty of maintaining such a field in the presence of excessive salivation.

Antisialogogues have been defined as agents that lessen or check the flow of saliva.[3] These drugs decrease the flow of saliva by inhibiting parasympathetic stimulation or by stimulating the sympathetic inhibitor. The agents generally used inhibit the excitation of acetylcholine on the chemoreceptor substance of the secretory cells.[2] The effectiveness of such drugs in reducing salivation in conjunction with general anesthetic agents has been reported in clinical studies.[4, 5, 6] However, there is only scanty evidence to support their use in reducing saliva volume during dental procedures when central nervous system control of salivation plays a more dominant role. This available evidence[7, 8] is based on casual observation and this is not sufficient to reach specific conclusions on salivary flow.[9] No previous controlled clinical study on a definite standard has been reported in the literature. This study was undertaken, then, to determine the effectiveness of potential agents in reducing saliva volume in clinical situations.

Method

Twenty-nine normal children between the ages of eight and twelve years were selected as test subjects. They were patients undergoing routine restorative dental treatment by students in the pediatric clinic of Washington University School of Dentistry. The children were free of any known allergies and were not receiving any concurrent medication. All had previous dental experience. It was required that each child be available for four consecutive two-hour appointments scheduled at the same time of day at one week intervals.

It is recognized that the variation in saliva volume is great and statistical reliability in the human being has been complicated by the variability in the rate of secretion, not only as applied to large numbers of individuals, but even for a single individual during short periods of collection under constant conditions.[10] To minimize this, although by no means erase it, a small number of subjects was selected and multiple observations were made on each subject. However, the variation within the individual even during short periods was anticipatedly great enough to prevent the use of "cross-over" or "paired" comparisons of the results. Each child received, then, a different medication each appointment but did not necessarily re-

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ceive all the medications during the appointment series.

An apparatus was devised that consisted of a calibrated 10 ml. vial introduced into a conventional saliva ejector system by means of a two-way valve which allowed quantitative recovery of all saliva entering this system during the test periods or normal functioning of the ejector system during dental procedures.

For sample collections, the mouth was first dried, the ejector tip placed lingual to the mandibular incisors, cotton rolls or isolating agents were removed and the saliva was collected for a timed interval.

Becks and Wainwright[11] found that the daily fluctuation in activated salivary flow is large when measured in terms of ml./hr. but that less fluctuation occurs with short collection periods. A five minute collection period, as used by Burrill and Fosdick,[12] was selected for this study to limit sample variation and to avoid appreciable interference in the dental treatment of the patient. The first sample was taken at the time of medication. Three additional samples were taken at thirty minute intervals during the appointment. Each of the four volumes was recorded by a student and an investigator. Any side effects were noted at each visit.

Four compounds with potential for reducing saliva flow during dental procedures were utilized in their usual therapeutic doses:

1. Atropine sulfate, 0.3 mg.
2. Scopolamine hydrobromide, 0.3 mg.
3. Promethazine hydrochloride (Phenergan), 12.5 mg.
4. Methantheline bromide (Banthine), 50 mg.

Atropine and scopolamine were selected to represent the belladonna alkaloids which have been long considered standards in this field.[13] Methantheline bromide, a drug with more specific parasympatholytic action, has been recommended on the basis of previous observations.[8] Promethazine hydrochloride, an antihistaminic agent with marked sedative action, was chosen on the basis of McDonald's work.[14]

All medication was administered orally prior to initiating dental procedures. Each medication was in the form of a coded tablet. Two placebos, corn starch and lactose, were also dispensed in commercially prepared tablet form. The resulting six code designations were unknown to the investigators until the conclusion of the experiment.

Results

Four hundred and sixty observations made on 115 administrations of the drugs yielded the data shown in Table 1.

TABLE 1

MEAN SALIVA VOLUMES AND STANDARD ERROR (ml./5 min.)
(95% Confidence Level)

Drug	*At Medication*	*30 Minutes*	*60 Minutes*	*90 Minutes*
Placebo	2.96 ±0.77	3.55 ±0.67	3.45 ±0.62	3.53 ±0.68
Atropine SO_4	2.88 ±1.08	3.49 ±1.01	3.50 ±0.90	3.21 ±1.10
Promethazine HCl	2.60 ±1.16	3.12 ±0.87	3.45 ±0.94	2.67 ±0.88
Methantheline Br	3.15 ±1.18	1.94 ±0.65	1.65 ±0.75	1.52 ±0.90
Scopolamine HBr	2.79 ±1.08	2.84 ±0.75	2.22 ±0.64	1.76 ±0.63

The use of a probability greater than 0.05 was not feasible from the standpoint of the sample volume. At the 95 per cent confidence level, though, a significant decrease in saliva volume was demonstrated by only one of the agents tested, methantheline bromide, at the three test intervals following medication. Scopolamine hydrobromide produced a significant reduction in saliva at the ninety minute interval. The volumes accompanying atropine sulfate and promethazine hydrochloride medication showed no reliable reduction when compared to the placebo values and, in fact, paralleled the latter closely.

Side effects produced by the drugs were minimal and none required corrective measures. A few cases of "flushing of the face" typically accompanied the use of atropine. Placebo reactions equalled those recorded for any of the active agents.

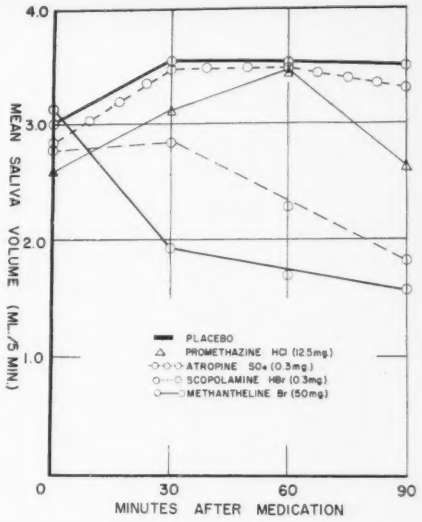

FIGURE 1

DISCUSSION

The mean saliva volumes are illustrated graphically (Figure 1). Of significance is the consistent increase in the volume of saliva in those cases receiving the placebos and those agents lacking early effectiveness when the initial and thirty minute values are compared. Since routine dental procedures began in each case during this interval, the increase in volume reflects the stimulation induced by such procedures and emphasizes the ability of methantheline, combating this stimulatory phase, to produce an early decrease in saliva volume. The unexpected linearity of the placebo values in the remaining two test periods additionally indicates a persistent stimulatory state throughout the dental appointment.

Another salient point illustrated in the graph is the effect induced by scopolamine hydrobromide. Although no significant decrease in saliva volume was obtained statistically until the ninety minute interval after medication, it appears that scopolamine does lessen the initial excitatory stage somewhat and, most importantly, that the drug induces a linear decrease in volume that could extend beyond the test period used in this study, producing the greatest decrease in volume among the agents compared. Certainly this point is worth further study. It might be mentioned here that the established onset of action of the drugs used should have fallen well within the time limit imposed by the study.

Although the doses used were thought to be therapeutically comparable, there is reasonable doubt in the investigators' minds that the 12.5 mg. dose of promethazine hydrochloride is perhaps as little as one-half of that which should have been used. Retesting promethazine at

the higher dosage level would decide this point.

Summary and Conclusions

Four agents with suspected indications for use in reducing saliva flow during dental procedures in children were administered in therapeutic doses to twenty-nine normal children by a repeated blind test pattern. The agents were atropine sulfate, scopolamine hydrobromide, methantheline bromide and promethazine hydrochloride. Two placebos were used for control comparison.

Five minute saliva volumes, obtained by a calibrated collecting vessel incorporated into the usual saliva ejector system, were gathered at thirty minute intervals during routine dental procedures and compared statistically.

On the basis of 115 administrations these facts seem valid:

1. Methantheline bromide exhibited the most rapid onset and greatest depression of saliva volume of the agents tested.

2. Scopolamine hydrobromide depressed salivation significantly only ninety minutes after medication but the results would indicate that it could produce the greatest reduction in salivation with a longer test period.

3. Atropine sulfate in the usual dose did not effectively diminish saliva volume during dental procedures with children.

4. Further evaluation of both scopolamine hydrobromide and methantheline bromide to determine their usefulness as adjuncts in pedodontic practice is indicated.

The authors wish to acknowledge the clinical assistance of Dr. John E. Gilster and the technical assistance of Mrs. Reba Cohea and Miss Peggy Tucker.

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BIBLIOGRAPHY

1. Langley, L. L. and Cheraskin, E., The physiological foundation of dental practice, ed. 1. St. Louis, 1951, C. V. Mosby Co., p. 372.
2. Dobbs, E. C., Pharmacology and oral therapeutics, ed. 11. St. Louis, 1956, C. V. Mosby Co., pp. 247-249.
3. Taber, C. W., Taber's cyclopedia medical dictionary, ed. 5. Philadelphia, 1949, F. A. Davis Co., p. A-27.
4. Album, M. M., General anesthesia and premedication in dentistry for children. J. Dent. Child., 24:279-282, 4th Quar., 1957.
5. West, J. S. and Papper, E. M., Preanesthetic medication for children. Anesthesiology, 11:279-282, Feb., 1950.
6. Sadove, M. S. and Frye, T. J., Preoperative sedation and production of quiescent state in children. Am. Med. A. J., 164:1729-1733, Aug., 1957.
7. Masters, D. H., Drug control of the dental salivary problem. Or. Surg., Or. Med. and Or. Path., 12:229-233, Feb., 1959.
8. Debre, A. J., Clinical report of one hundred cases using banthine as an antisialogogue in dental procedures. Dent. Digest, 57:210-213, May, 1951.
9. McDonald, R. E., Human saliva: A study of the rate and flow and viscosity and its relationship to dental caries. Master's Thesis. Indiana University, Nov. 22, 1950, p. 16.
10. Becks, H. and Wainwright, W. W., Human saliva. XIII. Rate of flow of resting saliva in healthy individuals. J. Dent. Res., 22:391-396, Oct., 1943.
11. Becks, H. and Wainwright, W. W., Human saliva. IX. The effect of activation on salivary flow. J. Dent. Res., 18:447-456, Oct., 1939.
12. Burrill, D. Y. and Fosdick, L. S., Buffering capacity and rate of flow of saliva. Northwest. Univ. Bul., 44-6-8, March, 1944.
13. Goodman, L. and Gilman, A., The pharmacological basis of therapeutics, ed. 6. New York, 1940, The Macmillan Co., p. 462.
14. McDonald, R. E., The effect of antihistaminic drugs on salivary flow and viscosity. J. Dent. Res., 32:224-226, April, 1953.

Early Permanent Molar Loss and Dental Caries*

SIDNEY B. FINN, D.M.D., M.S.**

THE question as to whether the extraction of first permanent molars in children will have an appreciable effect, either favorable or unfavorable, on the development of dental caries has not been clearly defined statistically. Wilkinson,[1] taking rather an extreme position, recommended extraction of all first permanent molars at ages eight to nine years in order to reduce the frequency of malocclusion and also to reduce the incidence of dental caries.

Conversely, Salzmann[2, 3] demonstrated that removal of the molars could result in malocclusion and also in an increase in the prevalence of dental caries. He offered evidence that the number of "exteeth" (decay experience) increased as the number of extracted first permanent molars increased. Also, that there were less "exteeth" per mouth when the molars were either caries free or were filled or carious. When the molars in individual mouths were filled or caries free there were on the average 5.7 "exteeth" as compared to 10.2 "exteeth" if there were molar extractions. However, regardless of what molars were missing there was a greater increase in the number of "exteeth" in the upper arch as compared to the lower arch. It is difficult to visualize how an extraction of a lower molar could appreciably alter the caries attack rate in the diagonally opposite quadrant. Certainly if there were any effect it would be of a lower magnitude and less than one would expect in the quadrant where the tooth was extracted. It appears that one would have to attribute at least some of the increase in caries attack rate to the same etiological factors that produced the need for extractions, namely, a conducive oral environment as well as lack of dental care and a neglect of the mouth in general.

If one is to eliminate as many variables as possible, one should have both the extracted tooth quadrant and the control quadrant in the same mouth. Comparisons also should be made between the same morphological types of teeth. One should not compare the upper with the lower teeth because of the morphologic differences. It has been shown in many studies[4] that dental caries is bilateral when comparing quadrants in the same arch. This relationship is closer than either comparing diagonal or opposing quadrants.[5]

INTRODUCTION

This study was designed to determine whether first molar extraction would affect the incidence of dental caries in the missing molar quadrant as compared to the opposite quadrant in the same arch. As pointed out by Salzmann, early first molar extraction generally leads to a distal drifting of the bicuspids to varying degrees. Parfitt[6] has demonstrated in clinical studies, and Nevin, *et al.*[7] in extra-oral studies that a relationship exists between the susceptibility of inter-

* This study was supported by a grant from the Colgate-Palmolive Company. Presented before the American Academy of Pedodontics, September 8, 1959, in New York City.

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proximal tooth surfaces to caries and the widths of the intervening interproximal areas. The greater the width of the interproximal area, the less susceptible are the adjacent proximal surfaces to dental caries. Nevin, *et al.* concluded from their studies: "The physical factor of spacing was of much greater importance than the buffering capacity of the external medium. An alteration in width of 0.07 mm. equaled the effect produced by a nine fold change in buffer capacity." The greater the separation of the surfaces the more rapid was the pH change in these areas, offering a rational explanation for what has been observed clinically. Therefore, in the study herein reported it was thought desirable to compare those interproximal surfaces which would be affected by distal drifting after molar extraction with the same surfaces of similar teeth on the opposite side of the arch. Those surfaces most likely to be affected would be the mesial and distal surfaces of the bicuspids and the distal surface of the cuspid, therefore, only these surfaces were included in the tabulation.

Procedure

Six hundred subjects from six to twenty-one years of age residing at the Alabama School for the Deaf and Blind received a thorough clinical examination with sharp explorer and mouth mirror under good light. The clinical examinations were augmented by full-mouth bitewing x-ray films which were read during the time of the clinical examination. All the examinations and x-ray interpretations were done by one examiner and all findings entered on specially designed cards by a trained recorder. All examinations were done primarily for another study and were completed before this study was contemplated, thus eliminating any unconscious personal bias.

Data

Among the six hundred children there were 192, averaging sixteen years of age, with one or more unilateral permanent first molar extractions, comprising 229 unilateral first molar extracted quadrants. These were divided into the following quadrants, 46 in the upper right,

TABLE I

No. of Individual Quadrants	*Average Age*	*Quadrant Location*	*No. of Quadrants With Missing 1st Per. Molars and Proximal Caries on the Bicuspids and Distal of Cuspid*	*No. of (Prox.) DMF Surfaces on Missing Molar Side*	*Opposite Quadrant Location With Molar Present*	*No. of Molars Present*	*No. of (Prox.) DMF Surfaces on Intact Molar Side*
46	16.3	U.R.	30	45	U.L.	30	71
60	16.6	U.L.	45	76	U.R.	45	120
58	15.4	L.R.	30	39	L.L.	30	55
65	15.3	L.L.	39	28	L.R.	39	58
Totals: 229			144	188		144	304

60 in the upper left, 58 in the lower right and 65 in the lower left. Of this number, 85 had no proximal caries on the surfaces being evaluated in either quadrant and therefore were not considered in this study. These were divided as follows: 16 in the upper right—left side, 15 in the upper left—right side, 28 in the lower right—left side, and 26 in the lower left—right side. The number of molar extractions in each quadrant and the corresponding caries experience (DMF proximal surfaces) on the extraction sides and opposite sides are presented in Table I.

It will be observed that the quadrants with the first molars extracted have a total of 188 DMF surfaces on the bicuspids and distal of the cuspid. In contrast the opposite quadrants in the same arches had a total of 304 DMF surfaces in the same teeth.

In using the Student t test to analyze for significance the chances of this difference occurring by chance alone would be less than one in a thousand, indicating a very high degree of significance. The statistical analysis is presented in Table II.

Among the total group of 144 quadrants 28 had more DMF surfaces on the side of the missing first molar, and 31 had the same number of DMF surfaces on both sides. Since it is not specifically known at what ages these teeth were extracted nor what the DMF rate of these surfaces were before the extractions, it is possible that some of the cavities in a few of these patients had developed prior to the extractions. If this were so then it would lend even greater weight to the results herein reported.

Discussion

These findings are in agreement with those obtained by Lind,[8] who observed a reduction in dental caries in specific areas following first molar loss among 13 children observed over a period of nine years, and are in contradiction to the findings of Salzmann who found an increase in the general overall caries picture which he attributed to first molar extractions.

The question of whether to extract a first permanent molar that is badly broken down and of questionable longevity in young children before the eruption of the second permanent molar has been an enigma in dental practice.

TABLE II

STATISTICAL ANALYSIS OF THE FINDINGS

	Total No.	*Total DMF*	*Mean of DMF (M)*	*Difference of Means*	*Standard Deviation*	*Standard Error (SE)*
Quadrants with molars extracted	144	188	1.305		1.420	.1183
Opposite quadrants with molars present	144	304	2.111	.806	1.359	.1132

$$t = \frac{M^1 - M^2}{\sqrt{(SE_1)^2 + (SE_2)^2}} \qquad t = \frac{.806}{\sqrt{.01399 + .01281}} \qquad t = \frac{.806}{\sqrt{.0268}} \qquad t = \frac{.806}{.1637} \qquad t = 4.92$$

P = less than 1 in .001 with 143 degrees of freedom

Advised opinion seems somewhat divided on this issue. After carefully weighing all factors this study would offer evidence that one should be inclined to remove first molar teeth as soon as their permanence becomes doubtful, not only to allow for a better alignment of the second permanent molars, but from a standpoint of dental caries prevention as well. This should not be interpreted as an endorsement for wanton indiscriminate extraction of first molars. However, it seems judicious that if first molars are to be extracted this should be done before the eruption of the second permanent molars and before the possible development of interproximal caries on the posterior teeth.

Conclusion

If one statistically compares the number of interproximal caries on one side of an arch, where the first permanent molar has been extracted for a period of time, with the opposite side, where the first permanent molar is present, one finds a significant reduction in the number of interproximal caries in the quadrant with the extracted first permanent molar. The frequently held belief that first molar extraction, per se, increases dental caries is untenable with these findings. This is not in contradiction to the finding of high caries prevalence in mouths with extracted molars, since both the need for extractions and high caries rates may have stemmed from common etiological factors, rather than from a cause and effect relationship.

BIBLIOGRAPHY

1. Wilkinson, A. A., The Early Extraction of the First Permanent Molar as the Best Method of Preserving the Dentition as a Whole. The Dental Record, 44:1, Jan., 1944.
2. Salzmann, J. A., Variation in Tooth Position Following Extraction of First Molars in Relation to Incidence and Distribution of Dental Caries. Jour. Dent. Res., 19:17, Feb., 1940.
3. Salzmann, J. A., Rate and Direction of Orthodontic Change and Effect on Incidence of Caries in 500 Adolescents Following Caries, Filling or Extraction of First Permanent Molars. J.A.D.A., 26:1991, Dec., 1939.
4. Finn, S. B., Prevalence of Dental Caries—Survey of the Literature of Dental Caries, Publication 225 National Academy of Sciences-National Research Council, Washington, D. C., 1952.
5. Public Health Aspects of Dental Decay in Children. School Health Research Monograph No. 111, American Child Health Assoc., 1930.
6. Parfitt, G. J., Conditions Influencing the Incidence of Occlusal and Interstitial Caries in Children. Jour. Dent. for Children, 23:31, 1st Quarter, 1956.
7. Nevin, R. B. and Walsh, J. P., Some Physicochemical Factors in Relation to the Causation of Interproximal Caries. Jour. Dent. Res., 30:235, April, 1951.
8. Lind, V., Den Systematika M. extraktionens inverkan pa Kariesfrekvensen. Odontologisk Rev., 5:218, 1954.

A Study of a Single Application of Eight Per Cent Stannous Fluoride

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THIS is the second year's report on a two-year clinical study in Olmsted County, Minnesota, designed to determine the effectiveness of a single topical application of an eight per cent stannous fluoride solution as an anticariogenic agent. Several studies have shown that stannous fluoride is a more effective anticariogenic agent than sodium fluoride.[1-3]

To provide further information on the duration of effectiveness of an eight per cent stannous fluoride solution, this study was continued throughout the second year. The conduct and experimental design of the study was described in detail in the first year report.[4]

PROCEDURES AND FOLLOW-UP EXAMINATIONS

The same methods and procedures for examinations and treatment were carried on in the follow-up examinations and treatments as explained in detail in the first year report.[4]

In the fall of 1957 the follow-up examinations and x-rays were taken in the same manner as described for the original group. Of the original 510 students, 472 were available for re-examination, 238 in the control group and 234 in the experimental group. Following this examination a second application of an eight per cent stannous fluoride solution was given to the experimental group.

In the fall of 1958, 420 students, who were now in the ninth and tenth grades, reported for their follow-up and final examination. The two groups are still very comparable with 211 in the control group and 209 in the experimental group. A recheck of this group as to the original caries experiences show the control group with a mean of 10.09 decayed, missing or filled (DMF) permanent teeth and 17.67 decayed, missing or filled (DMF) surfaces as compared to 10.30 decayed, missing or filled (DMF) permanent teeth for the experimental group and a mean of 17.66 DMF surfaces. The two groups are still very comparable as to the original caries experiences. Ninety students were lost to the study during the two years, due to moving out of jurisdiction and others quitting school.

FINDINGS

TOTAL TWO YEARS

First: Studying the results based on the total two years Table I shows the control group to have a caries incidence of teeth at the rate of 5.39 as compared to 3.35 for the experimental group or a reduction of 37.85 per cent following a single application of an eight per cent stannous fluoride solution applied annually for two years. The reversals show

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TABLE I

INCIDENCE OF CARIES FOLLOWING A SINGLE APPLICATION OF EIGHT PER CENT STANNOUS FLUORIDE SOLUTION APPLIED ANNUALLY FOR TWO YEARS TO 209 CHILDREN STARTING AT AGES 12-13 AS COMPARED TO A CONTROL GROUP 211, AGES 12-13

Location of New Caries	*Control Group No. 211*		*Experimental Group No. 209*		*Difference Between Groups*	*Difference in Per Cent*	*P*
	RATE	REVERSALS	RATE	REVERSALS			
Teeth	5.39 ±.184	0.024	3.35 ±.161	0.072	2.04	37.85	0.0001
Surfaces	12.81 ±.414	0.232	7.90 ±.344	0.364	4.91	38.32	0.0001

a ratio of 3-1 in favor of the experimental group. This can be interpreted as being the result of the stannous fluoride treatment.

In relation to surfaces, Table I shows the control group (211) to have an incidence of 12.81 DMFS over the two-year period. The experimental group during the same period shows an incidence of 7.90 DMFS or a reduction of 38.32 per cent. There is still a higher rate of reversals on the experimental side as compared to the control group, better than 50 per cent more reversals appear in the experimental group. The differences in Table I are highly significant as indicated by the low probabilities.

Table II shows the result of the two years as to specific surfaces. Over the two-year period following a single annual application of an eight per cent stannous fluoride solution applied to the erupted permanent teeth of the treated group the proximal surfaces in the treated group reveal a 45.14 per cent reduction in dental caries. The occlusal surfaces show 27.45 per cent reduction in the treated group. The buccolingual surfaces reveal only a 11.45 per cent reduction in the treated group as compared to the control. The probabilities for the proximal and occlusal surfaces indicate statistical significance.

Second Year Only

Table III shows the results during the second year of the study. The control

TABLE II

COMPARISON OF CARIES IN SURFACES OF TEETH OF EXPERIMENTAL AND CONTROL GROUPS AT THE END OF TWO YEARS FOLLOWING A SINGLE APPLICATION OF AN EIGHT PER CENT STANNOUS FLUORIDE SOLUTION ANNUALLY TO ERUPTED PERMANENT TEETH OF CHILDREN AGES 12-13 AT START OF STUDY

Surfaces	*Control Group No. 211*		*Experimental Group No. 209*		*Difference Between Groups*	*Difference in Per Cent*	*P*
	RATE	REVERSALS	RATE	REVERSALS			
Proximal	9.06 ±.331	0.113	4.97 ±.252	0.191	4.09	45.14	<0.0001
Occlusal	2.44 ±.119	0.033	1.77 ±.115	0.077	0.67	27.45	<0.0001
Buccolingual	1.31 ±.114	0.081	1.16 ±.107	0.095	0.15	11.45	.3371

TABLE III

INCIDENCE OF CARIES DURING THE SECOND YEAR, FOLLOWING A SINGLE APPLICATION OF EIGHT PER CENT STANNOUS FLUORIDE SOLUTION GIVEN ONCE EACH OF TWO YEARS TO ERUPTED PERMANENT TEETH OF CHILDREN 12-13 YEARS OF AGE

Location of New Caries	*Control Group No. 211*		*Experimental Group No. 209*		*Difference Between Groups*	*Difference in Per Cent*	*P*
	RATE	REVERSALS	RATE	REVERSALS			
Teeth	3.68 ±0.153	0.014	2.00 ±0.112	0.057	1.68	45.65	0.0001
Surfaces	8.98 ±0.322	0.185	4.56 ±0.218	0.397	4.42	49.22	0.0001

group had an incidence of new 3.68 teeth as compared to 2.00 teeth for the experimental group or a reduction of 45.65 per cent. Comparing this to the first year's report[4] which shows a difference of .43 teeth, it would appear that this second annual application of an eight per cent stannous fluoride solution in this study, increased its benefits by at least four fold.

When the DMFS surface index was used for comparative purposes the control group had an incidence of 8.98 surfaces as compared to 4.56 for the experimental or a reduction of 49.22 per cent. In the first year the difference was .69 surfaces. The second year shows six times the benefit of the first year. The difference in findings in Table III are highly significant.

The rate of reversals in Table III shows the experimental group to be four times greater than the control group in reference to teeth. In reference to surfaces the ratio is six times greater for the experimental group over the control group. It should be stated here that the examiner had no means of determining what group the individual was in, or what was the child's previous caries experience at the time of any of the examinations.

Table IV shows the difference in the incidence of caries between the two groups with regard to specific DMF surfaces during the second year. The proximal surfaces of the treated group were 53.45 per cent less carious than the same surfaces of the untreated group. The occlusal surfaces showed a 38.58 per cent

TABLE IV

COMPARISON OF CARIES IN SURFACES OF TEETH OF EXPERIMENTAL AND CONTROL GROUPS DURING THE SECOND YEAR FOLLOWING A SINGLE APPLICATION OF AN EIGHT PER CENT STANNOUS FLUORIDE SOLUTION GIVEN ANNUALLY FOR TWO YEARS TO ERUPTED PERMANENT TEETH OF CHILDREN 12-13 YEARS OF AGE

Surfaces	*Control Group No. 211*		*Experimental Group No. 209*		*Difference Between Groups*	*Difference in Per Cent*	*P*
	RATE	REVERSALS	RATE	REVERSALS			
Proximal	6.640 ±.260	0.076	3.091 ±.171	0.201	3.549	53.45	0.0001
Occlusal	1.550 ±.096	0.033	0.952 ±.077	0.043	0.598	38.58	0.0001
Buccolingual	0.791 ±.081	0.076	0.517 ±.063	0.153	0.274	34.64	0.0078

reduction in the treated group as compared to the untreated group. The buccolingual surfaces revealed a reduction of 34.64 per cent in the treated group. The greatest difference was in the proximal surfaces. All differences are highly significant.

The ratio of reversals is about 3-1 for the proximal surfaces in favor of the experimental group; approximately even for occlusal surfaces and 2-1 for buccolingual surfaces in favor of the experimental group. Table IV shows the reversals to be greater in the proximal and buccolingual surfaces. The higher rates of reverses in the treated group can be interpreted as the results of the stannous fluoride treatment. The treatment according to this study has its greatest benefits on the proximal surfaces.

The additional annual topical application of an eight per cent stannous fluoride solution increases its benefits four to six times as compared to the first year's results on the same teeth.

Summary

Over a two-year period this study lost 90 participants, starting with 510 students and ending with 420 (209 on experimental side and 211 on control). This study started with 12-13 age groups in the seventh and eighth grades. After two years the groups were spread out in several high schools increasing the difficulty of scheduling.

The initial caries rate of the remaining two groups were comparable. The control group had a DMF teeth of 10.09 and 17.67 DMFS surfaces as compared to 10.30 DMF teeth and 17.66 DMFS surfaces for the experimental group.

At the end of the first year the control group had an incidence of 2.15 teeth. At the end of the second year the incidence for the second year had increased to 3.68. This made a difference of 1.53.

The experimental group showed an incidence of 1.72 teeth for the first year and 2.00 teeth for the second year. A slight increase of .28 on the second year as compared to the 1.53 teeth for the control.

In the surfaces the same relation exists. The first year the incidence of carious surfaces was 4.79 in the control group, while the second year showed 8.98 surfaces. An increase of 4.19 surfaces for the second year.

In the experimental group the first year reveals an incidence of carious surfaces at a rate of 4.10. The second year incidence showed only a slight increase to 4.56. The difference of .46 compared to 4.19 shows a ratio of 6-1 in favor of the treatment of stannous fluoride.

Since an educational program was conducted in conjunction with this study for all participants, and since the control group received the same information regarding good dental health practices as the experimental group and since both groups were given the same type of tooth paste (non-fluoride) to use, the beneficial results found in this study by the use of an eight per cent stannous fluoride solution have a greater significant value.

Conclusions

The second single application of an eight per cent stannous fluoride solution applied topically to erupted permanent teeth increased its benefits of reducing dental caries about four fold. This is based on the differences of incidence of the first year's results (which was 0.43) as compared to the second year differ-

ences in incidence of 1.68. The surfaces show a relation of differences of .69 for the first year to 4.41 for second year.

Over the period of two years one single application of an eight per cent stannous fluoride solution applied annually to erupted permanent teeth starting with a group of children ages 12-13 reduced dental caries 37.85 per cent in teeth and 38.32 per cent in surfaces. These findings are statistically significant.

BIBLIOGRAPHY

1. Howell, C. L., Gish, C. W., Smiley, R. D. and Muhler, J. C., Effect of topically applied stannous fluoride on dental caries experience in children. J. Am. Dent. A., 50:14-17, Jan., 1955.
2. Muhler, J. C., Nebergall, W. H. and Day, H. J., Studies on stannous fluoride and other fluorides in relation to the solubility of enamel in acid and the prevention of experimental dental caries. J. Dent. Res., 33:33-49, Feb., 1954.
3. Gish, C. W., Howell, C. L. and Muhler, J. C., A new approach to the topical application of fluorides in children, with results at the end of two years. J. Dent. Child., 24:194-196, Sept., 1957.
4. Jordan, Wm. A., Snyder, John R. and Wilson, Viktor, Stannous Fluoride Clinical Study in Olmsted County, Minnesota. Public Health Reports, Vol. 73, 11:1010-1014, Nov., 1958.

Book Review

AN INTRODUCTION TO PERIODONTIA, by Henry M. Goldman, D.M.D., F.A.C.D., Saul Schluger, D.D.S., D. Walter Cohen, D.D.S., Bernard Chaikin, D.M.D., F.A.C.D, Lewis Fox, D.D.S., F.A.C.D. C. V. Mosby Company, 1959, 346 pages with 180 illustrations. Price $7.75. The Postgraduate Dental Lecture Series.

This book was written for the dental student or the man in general practice. The field of periodontics has grown so extensively that within the last five years many excellent textbooks on this subject have been written or revised. However, too frequently they discourage the practicing dentist who recognizes for the first time the scope of periodontics and realizes the need for basic knowledge and experience and the book invariably becomes part of the dust-collecting group which is going to be read "as soon as he has time."

The book reviewed herewith is different. First, the reader is not overwhelmed by its size, secondly, the material presented is within the scope of the person being introduced to the subject, which would include the student, the dentist who has not participated in postgraduate courses or even those who were not taught the subject in undergraduate school.

The bibliography has been carefully prepared to encourage the use of the selected references. The outline of the chapters is logical and in good sequence. The illustrations are plentiful and clear.

The recent interest in gingivoplasty, osteoplasty and osteoectomy along with muco-gingival surgery is well discussed, along with indications and results in the chapter on Therapy of Marginal Lesions.

The review of anatomy, histology and physiology is brief, but for the postgraduate student it is adequate and the undergraduate student is provided with such information in other courses.

The chapter on classification of periodontal diseases follows the accepted terminology set forth by the American Academy of Periodontology.

The other chapters are well written and easily read. If one is to accept this book as a text it should be supplemented by more advanced texts. If the book is used for the purpose intended, to stimulate in the student and the practitioner an interest in periodontics, then it very definitely fulfills its objective.

DONALD K. POKORNY

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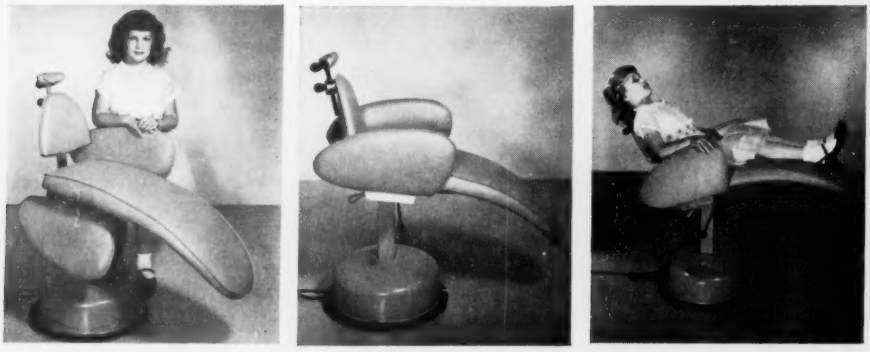

Functional Design — Purposeful Styling

PedOchairs bring a leisure, informal atmosphere to the operatory. Apprehension and fear are minimized. The PedOchair comfortably supports children within the age span of 2 to 12 years. Their trim styling and compact design "put the patient in your lap." Electrically controlled, units are elevated and lowered hydraulically. A selection of control centers, both local and remote for hand or foot, afford a wide variety of unique installations. Remote controlled units allow the chair base to be concealed beneath the floor presenting operatory elegance heretofore unattainable. A number of unique design features are incorporated in the PedOchair. Write for our descriptive catalog.

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